

Helicarionid Snails of Mounts Mahermana, Ilapiry, and Vasiha, Southeastern Madagascar

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Abstract. Quantitative, replicated altitudinal transects yielded 30 helicarionid species in five genera in four subfamilies. Descriptions are given of *Kalidos balstoni* (Angas, 1877); *K. fenni* sp. nov.; *K. prenanti* Fischer-Piette, Blanc, Blanc & Salvat, 1994; *K. richardi* sp. nov.; *K. striaspiralis* sp. nov.; *K. vasihae* sp. nov.; *K. zahamenensis* Fischer-Piette, Blanc, Blanc & Salvat, 1994; *Kaliella barrakporensis* (Pfeiffer, 1852); *Malagarion tillieri* sp. nov.; *Microcystis andriamahajai* sp. nov.; *Mic. basampla* sp. nov.; *Mic. blanci* sp. nov.; *Mic. castanea* sp. nov.; *Mic. compacta* sp. nov.; *Mic. esetra* sp. nov.; *Mic. ilapiriensis* sp. nov.; *Mic. mahermanae* sp. nov.; *Mic. subangulata* sp. nov.; *Mic. subplanata* sp. nov.; *Mic. vohimena* sp. nov.; *Mic. vohimenoidea* sp. nov.; *Sitala alicae* sp. nov.; *S. amabilis* Fischer-Piette & Salvat, 1966; *S. elegans* sp. nov.; *S. euconuliforma* sp. nov.; *S. gaudens* Fischer-Piette & Salvat, 1966; *S. ilapiryae* sp. nov.; *S. josephinae* sp. nov.; *S. soa* sp. nov.; and *S. vasihae* sp. nov.

INTRODUCTION

This paper is the final in a series of four that identify and describe the species reported on as morphospecies by Emberton et al. (1996, 1999) and Emberton (1997). This paper treats the Mahermana-Ilapiry-Vasiha helicarionids.

MATERIALS AND METHODS

Collecting methods have been detailed by Emberton et al. (1996). Sixteen stations were collected and numbered in the "Tol" series (for Tolagnaro = Fort Dauphin, the nearest city). These stations have been mapped by Emberton et al. (1996, 1999) and in Emberton (1997). To shorten the taxonomic descriptions, stations are described briefly below. Catalogued station numbers, given in parentheses, are in the series of the Molluscan Biodiversity Institute (MBI). All stations were restricted to primary forest that had no more than limited selective cutting. Ecological data are given by Emberton (1997:table 1). All stations are in Madagascar: Tulear Province. Mount Mahermana (Vohimena Chain) is northeast of the village of Esetra, Ilapiry (Vohimena Chain) is west of Mahialambo, and Vasiha (Anosy Chain) is west of Malio. Latitude and longitude are given in degrees, minutes, and seconds.

MBI 373 (= Tol-1). Summit of Mt. Mahermana, 340 m, 24°26'12"S, 47°13'13"E.

MBI 374 (= Tol-2). Slope of Mt. Mahermana, 300 m, 24°26'17"S, 47°13'10"E.

MBI 375 (= Tol-3). Slope of Mt. Mahermana, 200 m, 24°26'15"S, 47°13'04"E.

MBI 376 (= Tol-4). Valley on Mt. Mahermana, 100 m, 24°26'22"S, 47°12'41"E.

MBI 377 (= Tol-5). Summit of Mt. Ilapiry, 540 m, 24°51'40"S, 47°00'20"E.

MBI 378 (= Tol-6). Ridge on Mt. Ilapiry, 500 m, 24°51'33"S, 47°00'27"E.

MBI 379 (= Tol-7). Ridge, valley, and slope on Mt. Ilapiry, 400 m, 24°51'27"S, 47°00'38"E.

MBI 380 (= Tol-8). Slope of Mt. Ilapiry, 300 m, 24°51'36"S, 47°00'40"E.

MBI 381 (= Tol-9). Slope of Mt. Ilapiry, 200 m, 24°51'39"S, 47°00'46"E.

MBI 382 (= Tol-10). Lower summit of Mt. Vasiha, 860 m, 24°55'18"S, 46°44'19"E.

MBI 383 (= Tol-11). Slope of Mt. Vasiha, 700 m, 24°55'23"S, 46°44'27"E.

MBI 384 (= Tol-12). Slope of Mt. Vasiha, 500 m, 24°55'19"S, 46°44'45"E.

MBI 385 (= Tol-13). Valley on Mt. Vasiha, 400 m, 24°55'25"S, 46°44'45"E.

MBI 386 (= Tol-14). Slope of Mt. Vasiha, 300 m, 24°55'37"S, 46°44'49"E.

MBI 387 (= Tol-15). Slope of Mt. Vasiha, 200 m, 24°56'13"S, 46°45'13"E.

MBI 388 (= Tol-16). Slope of Mt. Vasiha, 100 m, 24°56'20"S, 46°46'07"E.

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MBI 389 (= Tol-3-4). Incidental collecting between Tol-3 and Tol-4.

MBI 390 (= Tol-1-2). Incidental collecting between Tol-I and Tol-2.

MBI 391 (= Tol-sub-5). Incidental collecting below summit of Mt. Ilpiry, Tol-5.

MBI 392 (= Tol-7-9). Incidental collecting between Tol-7 and Tol-9.

Species identifications and comparisons were made using Fischer-Piette et al. (1994) and Emberton (1994). For each species, the holotype or a representative shell was photographed in apertural, apical, and basal views at 6.4×, 10×, 16×, 25×, or 40× magnification, and in apical view at 40× magnification (Figures 1–39). Shell characters were measured, or measured and calculated, or scored from the photographs or from the shells themselves. A shell-character matrix was prepared and used to code character-state data into the DELTA system (Dallwitz et al., 1993), which was then used to generate natural-language species descriptions.

SYSTEMATICS

Higher classification follows Ponder & Lindberg (1997), Nordsieck (1986), and Vaught (1989). Type materials are placed in the United States National Museum, Washington, D.C. (USNM); temporarily in the Molluscan Biodiversity Institute (MBI), whose collections will revert to the Florida Museum of Natural History, Gainesville; and in the Australian Museum, Sydney (AMS); the Muséum national d'Histoire naturelle, Paris (MNHN, which does not assign catalog numbers to its types); and the Academy of Natural Sciences of Philadelphia (ANSP). For paratype localities, use the MBI catalog number to refer to the station numbers (in parentheses) above. MBI catalog numbers consist of station number, period, species number, D (dry) or A (alcohol-preserved), and when appropriate H (holotype) or P (paratype) and/or R (representative).

Class GASTROPODA

Clade HETEROBRANCHIA

Clade PULMONATA

Order STYLOMMATOPHORA

Suborder SIGMURETHRA

Infraorder HELICIDA

Superfamily HELICARIONOIDEA

Family HELICARIONIDAE: Subfamily SESARINAE

Genus *Kaliella* Blanford, 1863

Kaliella barrakporensis (Pfeiffer, 1852)

(Figure 39)

Kaliella sp. 01, Emberton et al., 1996:210. Emberton, 1997: 1147.

Representative: MBI 374.02DR, Tol-2 (ad).

Other specimens: MBI 373.21D (1 ad), MBI 376.19D (2 ad), MBI 377.23A (1 ad), MBI 379.31D (2 ad, 2 juv), MBI 379.31A (1 ad), MBI 380.23D (1 ad), MBI 381.22D (1 ad, 1 juv; AMS c.203461 [1 ad]), MBI 382.24D (1 ad, 1 juv).

Description of representative:

Shell Size and Shape. Diameter 3.0 mm; height 2.8 mm. Height-diameter ratio 0.94. Whorls 5.4. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 4.9. Spire angle 85 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, pre-sutural ridge present. Suture depth one half whorl from aperture is 1.2% of shell diameter. Umbilicus 3% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 49% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.59. Distance between the columellar and upper peristome insertions 81% of aperture width. Penultimate whorl projects into body whorl, occupying 14% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 95 degrees.

Apex. First whorl diameter 0.4 mm. First two whorls diameter 0.8 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell with very fine, regularly spaced, crowded transverse lines.

Variation: No conspicuous variation in size or shape.

Distribution: Mts. Mahermana, Ilpiry, and Vasiha at 100 to 860 m elevation (this paper), and India, Himalaya, Abyssinia, Comores, Mozambique, South Africa, and widespread on Madagascar (Fischer-Piette et al., 1994).

Family HELICARIONIDAE: Subfamily
MICROCYSTINAE

Genus *Microcystis* Beck, 1837

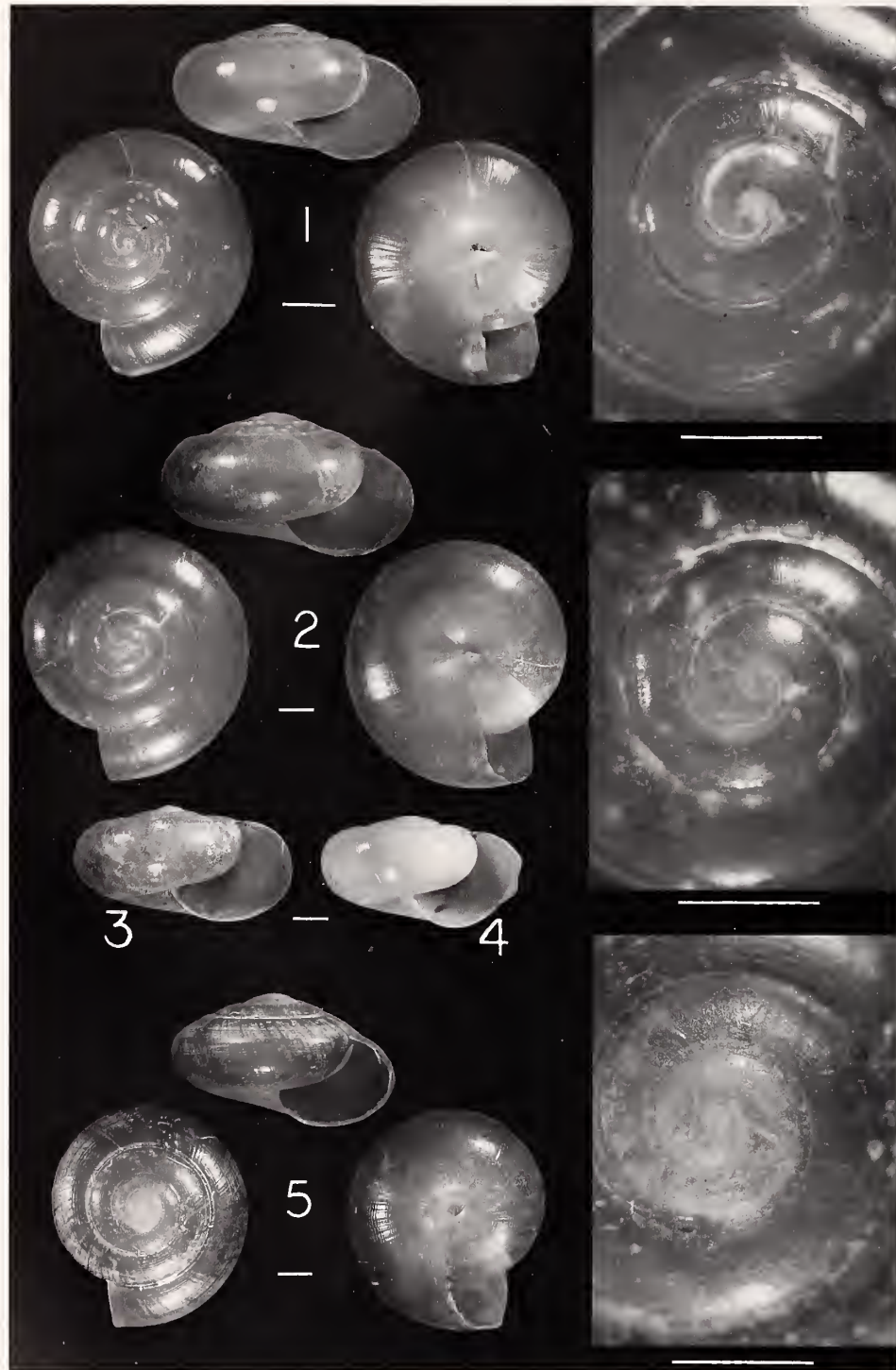
Microcystis subplanata Emberton & Pearce, sp.
nov.

(Figures 1, 2, 3, 4)

Microcystis sp. 01, Emberton et al., 1996:210. Emberton, 1997:1146, 1150.

Holotype: USNM 860818 (ex MBI 373.09DH, Tol-1, ad).

Paratypes: MBI 373.09DP (2 ad, 7 juv; AMS C. 203462 [1 ad]; MNHN [1 ad]; ANSP 400840 [1 ad]), MBI 373.09AP (2 ad, 2 juv), MBI 374.19DP (1 ad, 1 juv),



Figures 1–5

Figures 1–4. *Microcystis subplanata* Emberton & Pearce, sp. nov., holotype (Figure 1, four views) and paratypes MBI 373.09DP (Figure 2, three views and spire), MBI 373.09DP (Figure 3, one view), and MBI 374.19DP (Figure 4, one view). Figure 5 (four views). *Microcystis castanea* Emberton & Pearce, sp. nov., holotype. All scale bars 1 mm.

MBI 375.17DP (3 juv), MBI 375.17AP (2 juv), MBI 390.03DP (1 juv).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: northeast of village of Esetra: Summit of Mt. Mahermana, 340 m, 24°26'12"S, 47°13'13"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 7.0 mm; height 3.8 mm. Height-diameter ratio 0.55. Whorls 4.5. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.3. Spire angle 145 degrees. Shell not domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 0.7% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 1.1% of shell diameter. Umbilicus 0% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 47% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.77. Distance between the columellar and upper peristome insertions 85% of aperture width. Penultimate whorl projects into body whorl, occupying 32% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 65 degrees.

Apex. First whorl diameter 1.0 mm. First two whorls diameter 1.8 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; incised lines extremely fine, more than 30 lines between sutures.

Variation: The spire can be almost entirely flat, and empty shells sometimes bleach white. The largest specimen (station MBI 373) is 8.2 mm in diameter, with 4.2 whorls.

Comparisons: Shape similar to *Microcystis platysma* Emberton, 1994, but two-thirds the diameter for slightly more whorls and with a narrower aperture. At least 50% larger for the same number of whorls as *M. argueyrolli* Fischer-Piette, Blanc, Blanc & Salvat, 1994.

Distribution: Mt. Mahermana, 200–340 m elevation.

Etymology: For its somewhat (L. *sub-*, under) flat (L. *plan-*) shell shape.

Microcystis castanea Emberton & Pearce, sp. nov.

(Figure 5)

Microcystis sp. 02, Emberton et al., 1996:210. Emberton, 1997:1147, 1150.

Holotype: USNM 860819 (ex MBI 373.10DH, ToI-1, ad).

Paratypes: MBI 373.10DP (1 ad; AMS C.203463 [1 ad]; MNHN [1 ad]), MBI 374.20DP (1 ad), MBI 375.18DP (1 ad; ANSP 400841 [1 ad]).

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: northeast of village of Esetra: southeast slope of Mt. Vasiha, 700 m, 24°55'23"S, 46°44'27"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 6.2 mm; height 3.8 mm. Height-diameter ratio 0.61. Whorls 4.8. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.6. Spire angle 140 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 0.3% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 2.2% of shell diameter. Umbilicus 6% of shell diameter. Shell color red-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 50% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.68. Distance between the columellar and upper peristome insertions 81% of aperture width. Penultimate whorl projects into body whorl, occupying 29% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 95 degrees.

Apex. First whorl diameter 1.1 mm. First two whorls diameter 2.1 mm. Embryonic sculpture of interrupted spiral ridges.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; about 15 fine incised lines between sutures.

Variation: The largest shell (station MBI 373) has a diameter of 7.8 mm, with 4.8 whorls.

Comparisons: Fewer and more rapidly expanding whorls than *Microcystis arnali* Fischer-Piette, Blanc, Blanc & Salvat, 1994, which lacks the spiral grooves of this species and is light, not dark, in color.

Distribution: Mt. Mahermana, 200–340 m elevation.

Etymology: For its chestnut (L. *castane-*) shell color, dark for the genus.

Microcystis compacta Emberton & Pearce, sp.
nov.

(Figures 6, 7)

Microcystis sp. 03, Emberton et al., 1996:210. Emberton, 1997:1146, 1150.

Holotype: USNM 860820 (ex MBI 378.04DH, Tol-6, ad).

Paratypes: MBI 373.18DP (1 juv), MBI 373.18AP (3 ad), MBI 374.21DP (1 juv), MBI 375.23AP (1 juv), MBI 376.12DP (1 ad, 1 juv), MBI 376.12AP (1 ad), MBI 377.16DP (3 ad, 1 juv), MBI 377.16AP (1 juv), MBI 378.04DP (2 juv; AMS C.203464 [1 ad]; MNHN [1 ad]; ANSP 400842 [1 ad]), MBI 378.04AP (2 ad, 1 juv), MBI 379.24DP (1 ad, 4 juv), MBI 379.24AP (2 juv), MBI 380.17DP (1 ad, 1 juv), MBI 380.17AP (2 ad, 2 juv), MBI 381.17DP (2 juv), MBI 382.17DP (13 juv), MBI 382.17AP (2 ad, 2 juv), MBI 383.11DP (1 ad), MBI 384.15DP (1 juv), MBI 387.10DP (2 juv), MBI 387.10AP (1 juv), MBI 391.03DP (1 juv).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: west of village of Mahialambo: Ridge on east face of Mt. Ilapiry, 500 m, 24°51'3"S, 47°00'27"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 8.4 mm; height 5.9 mm. Height-diameter ratio 0.71. Whorls 5.2. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.4. Spire angle 125 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 1.1% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 0.7% of shell diameter. Umbilicus 2% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 53% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.66. Distance between the columellar and upper peristome insertions 85% of aperture width. Penultimate whorl projects into body whorl, occupying 30% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 80 degrees.

Apex. First whorl diameter 0.7 mm. First two whorls diameter 1.3 mm. Embryonic sculpture of weak spiral ridges then also with weak growth wrinkles.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth, no sculpture other than weak, irregularly spaced growth wrinkles.

Variation: There is some slight variation in darkness of

shell coloration, but no conspicuous variation in size or shape.

Comparisons: Very similar to *Microcystis amali* Fischer-Piette, Blanc, Blanc & Salvat, 1994, but conspicuously more elevated, with a squarer aperture, lacking any trace of peripheral angulation, and with slightly looser coiling.

Distribution: Mts. Mahermana, Ilapiry, and Vasiha, 100–860 m elevation.

Etymology: For its compact shape.

Microcystis vohimena Emberton & Pearce, sp.
nov.

(Figure 8)

Microcystis sp. 04, Emberton et al., 1996:209, 210. Emberton, 1997:1146, 1150.

Holotype: USNM 860821 (ex MBI 373.11DH, Tol-1, ad).

Paratypes: MBI 373.11DP (1 ad, 1 juv; AMS C.203465 [1 ad]; MNHN [1 ad]), MBI 373.11AP (1 ad, 1 juv), MBI 375.19DP (1 juv), MBI 375.19AP (1 ad), MBI 376.24AP (1 ad), MBI 377.17DP (2 ad, 3 juv), MBI 377.17AP (1 juv), MBI 378.24AP (1 ad, 1 juv).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: northeast of village of Esetra: Summit of Mt. Mahermana, 340 m, 24°26'12"S, 47°13'13"E: primary rainforest.

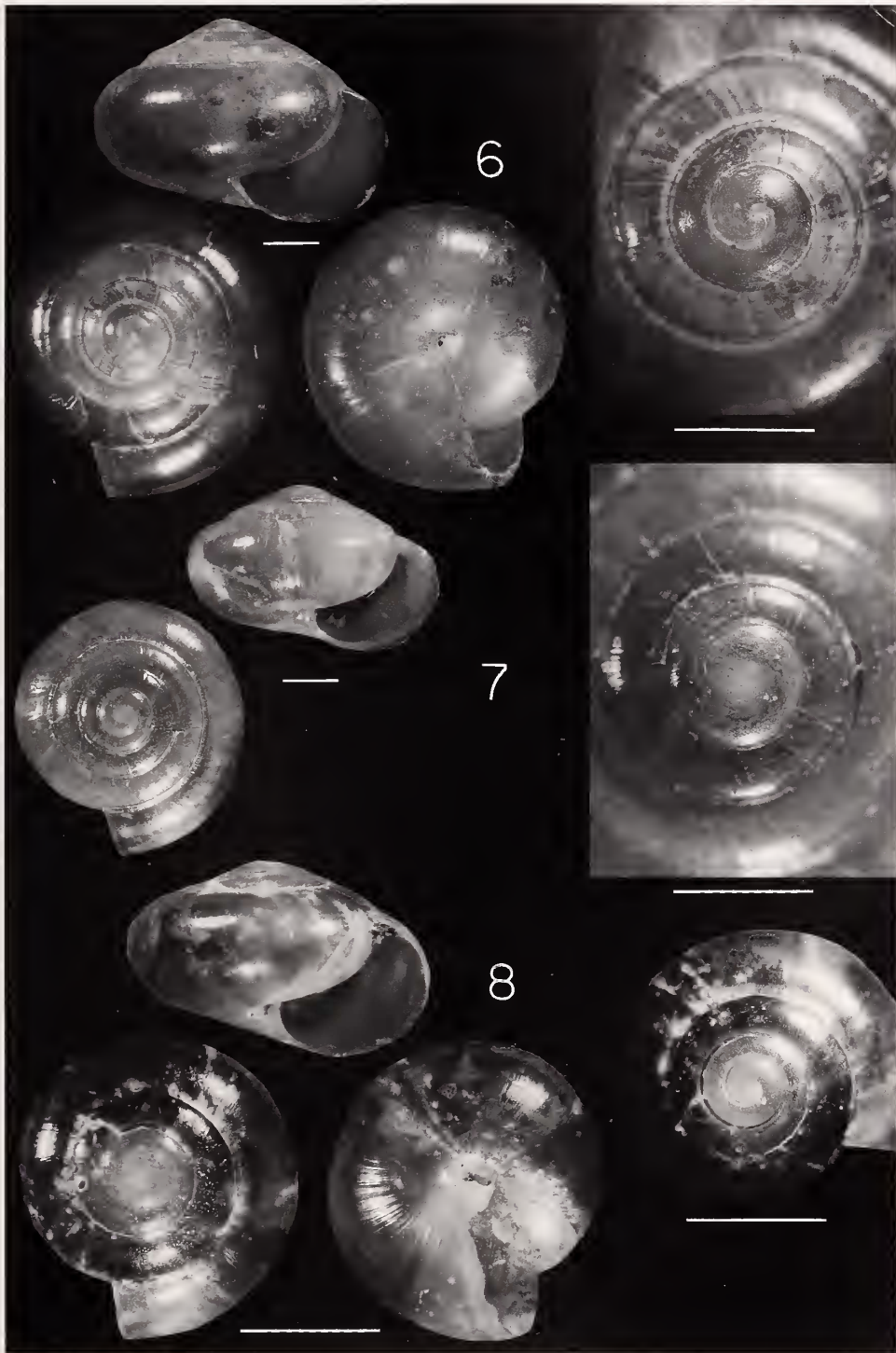
Description of holotype:

Shell Size and Shape. Diameter 2.2 mm; height 1.4 mm. Height-diameter ratio 0.66. Whorls 4.1. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 5.2. Spire angle 130 degrees. Shell not domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 0.2% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 1.0% of shell diameter. Umbilicus 1% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 51% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.71. Distance between the columellar and upper peristome insertions 76% of aperture width. Penultimate whorl projects into body whorl, occupying 30% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 110 degrees.

Apex. First whorl diameter 0.4 mm. First two whorls diameter 0.7 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell



Figures 6–8

Figures 6, 7. *Microcystis compacta* Emberton & Pearce, sp. nov., holotype (Figure 6) and paratype MBI 376.12DP (Figure 7). Figure 8. *Microcystis vohimena* Emberton & Pearce, sp. nov., holotype. All scale bars 1 mm.

smooth, no sculpture other than weak, irregularly spaced growth wrinkles.

Variation: The largest specimen, from station MBI 373, has a diameter of 2.4 mm, with 4.0 whorls.

Comparisons: Similar in shape to but smaller and more tightly coiled than *Microcystis ilapiriensis* sp. nov., and lacking its basal spiral-line sculpture. Similar in size and coiling tightness to *M. vohimenooides* sp. nov., but without its wide umbilicus, low aperture, and spiral-line sculpture.

Distribution: Vohimena chain (Mts. Mahermana and Ilapiry), 100 to 540 m elevation.

Etymology: For the Vohimena Mountain chain, north of Ft. Dauphin.

Microcystis ilapiriensis Emberton & Pearce, sp.
nov.

(Figure 9)

Microcystis sp. 05, Emberton et al., 1996:210. Emberton, 1997:1147.

Holotype: USNM 860822 (ex MBI 379.04DH, Tol-7, ad).

Paratypes: MBI 379.04DP (1 juv; AMS C.203466 [1 ad]).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: west of village of Mahialambo: Ridge, valley, and slope on southsoutheast face of Mt. Ilapiry, 400 m, 24°51'27"S, 47.00.38E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 3.5 mm; height 2.2 mm. Height-diameter ratio 0.63. Whorls 4.8. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 3.8. Spire angle 125 degrees. Shell not domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 0.3% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 2.0% of shell diameter. Umbilicus 4% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 53% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.61. Distance between the columellar and upper peristome insertions 79% of aperture width. Penultimate whorl projects into body whorl, occupying 31% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 90 degrees.

Apex. First whorl diameter 0.6 mm. First two whorls diameter 1.1 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell with very fine granulations. Shell base with fine incised spiral lines.

Comparisons: Most similar to *Microcystis vohimena* sp. nov., but larger, with looser coiling, and with spiral lines on the base.

Distribution: Mt. Ilapiry, 400 m elevation.

Etymology: For Mount Ilapiry, southern Vohimena Chain.

Microcystis vohimenooides Emberton & Pearce, sp.
nov.

(Figure 10)

Microcystis sp. 06, Emberton et al., 1996:210. Emberton, 1997:1148.

Holotype: USNM 860823 (ex MBI 380.02DH, Tol-8, ad).

Paratypes: MBI 380.02DP (0; AMS C.203467 [1 ad]), MBI 382.18DP (1 ad).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: west of village of Mahialambo: south slope of Mt. Ilapiry, 300 m, 24°51'36"S, 47°00'40"E: primary rainforest.

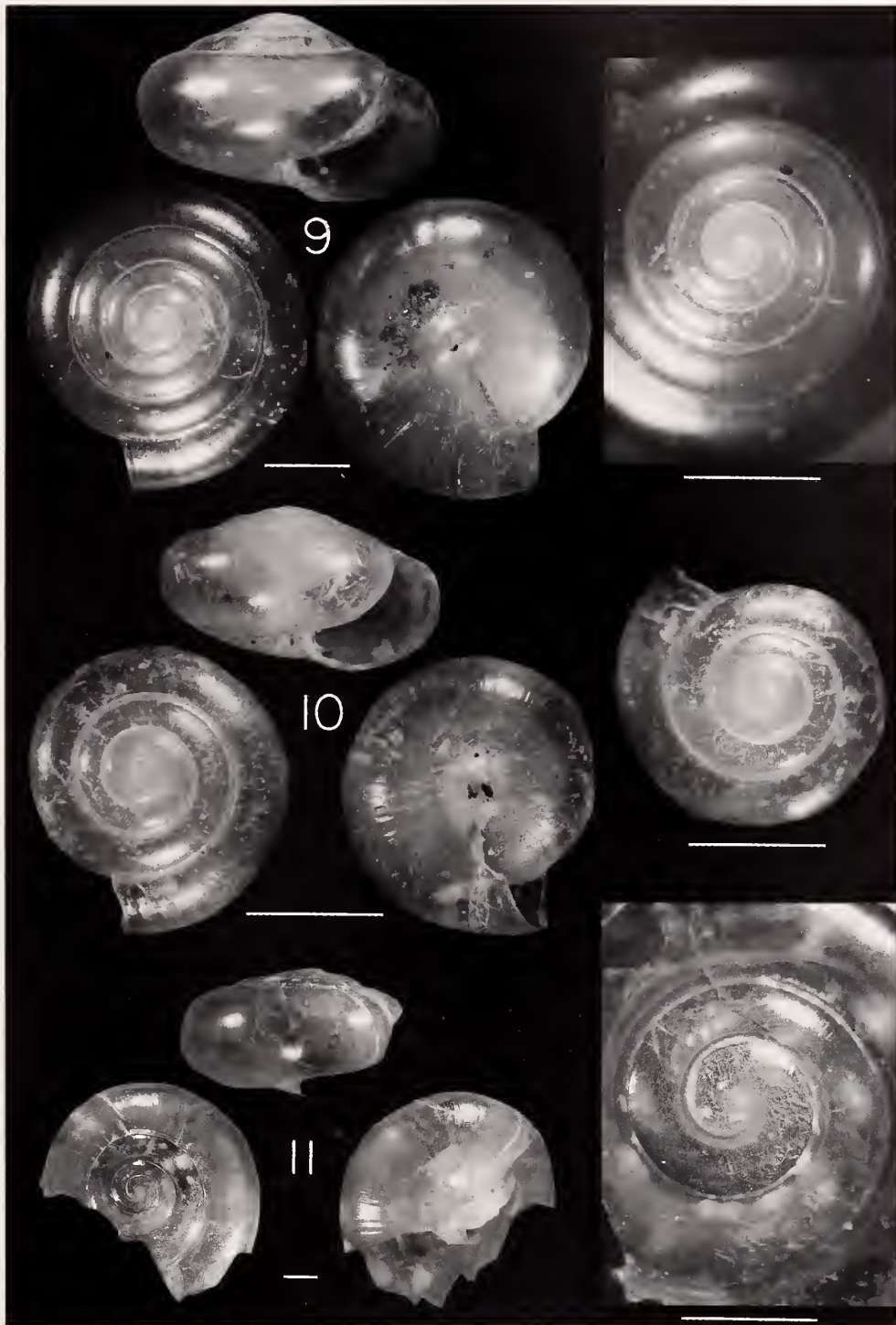
Description of holotype:

Shell Size and Shape. Diameter 2.1 mm; height 1.2 mm. Height-diameter ratio 0.59. Whorls 3.7. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 5.0. Spire angle 140 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 1.2% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 2.6% of shell diameter. Umbilicus 8% of shell diameter. Shell color white.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 50% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.63. Distance between the columellar and upper peristome insertions 75% of aperture width. Penultimate whorl projects into body whorl, occupying 32% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 105 degrees.

Apex. First whorl diameter 0.4 mm. First two whorls diameter 0.9 mm. Embryonic sculpture of weak spiral striae.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on



Figures 9–11

Figure 9. *Microcystis ilapiriensis* Emberton & Pearce, sp. nov., holotype. Figure 10. *Microcystis volhimenoides* Emberton & Pearce, sp. nov., holotype. Figure 11. *Microcystis esetra* Emberton & Pearce, sp. nov., holotype. All scale bars 1 mm.

upper parts of shell; about 10 fine incised lines between sutures.

Variation: No conspicuous variation in size or shape.

Comparisons: Similar in its small size and extremely tight coiling to *Microcystis vohimena* sp. nov., but with a much lower aperture and wider umbilicus, and with a sculpture of incised spiral lines.

Distribution: Mts. Ilapiry and Mt. Vasiha, 300 to 860 m elevation.

Etymology: For its resemblance to *M. vohimena* sp. nov.

Microcystis esetra Emberton & Pearce, sp. nov.

(Figure 11)

Microcystis sp. 07, Emberton et al., 1996:210. Emberton, 1997:1148.

Holotype: USNM 860824 (ex MBI 375.03DH, Tol-3, ad; body preserved as MBI 375.03AH).

Paratypes: None.

Type Locality: Madagascar: Tulear Province: north of Fort Dauphin: northeast of village of Esetra: west slope of Mt. Mahermana, 200 m, 24°26'15"S, 47°13'04"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 6.6 mm; height 3.9 mm. Height-diameter ratio 0.59. Whorls 4.2. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.2. Spire angle 150 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 0.9% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 1.9% of shell diameter. Umbilicus 5% of shell diameter. Shell color orange-brown.

Apex. First whorl diameter 0.9 mm. First two whorls diameter 1.9 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; incised lines extremely fine, more than 30 lines between sutures.

Comparisons: Like an enlarged version of *Microcystis argueyrolli* Fischer-Piette, Blanc, Blanc & Salvat, 1994, which it closely resembles in shape and, apparently, sculpture, but with a diameter of 6.6 mm for four whorls, as opposed to 5 mm for five whorls in *M. argueyrolli*.

Distribution: Mt. Mahermana, 200 m elevation.

Etymology: For the village of Esetra.

Microcystis andriamahajai Emberton & Pearce, sp. nov.

(Figure 12)

Microcystis sp. 08, Emberton et al., 1996:210. Emberton, 1997:1148, 1150.

Holotype: USNM 860825 (ex MBI 375.04DH, Tol-3, ad; body preserved as MBI 375.04AH).

Paratypes: MBI 375.04DP (1 juv), MBI 376.13DP (2 ad, 1 juv; AMS C.203468 [1 ad]; MNHN [1 ad]).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: northeast of village of Esetra: west slope of Mt. Mahermana, 200 m, 24°26'15"S, 47°13'04"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 3.3 mm; height 2.3 mm. Height-diameter ratio 0.70. Whorls 4.8. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 4.0. Spire angle 125 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 1.1% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 1.2% of shell diameter. Umbilicus 5% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 54% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.60. Distance between the columellar and upper peristome insertions 82% of aperture width. Penultimate whorl projects into body whorl, occupying 33% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 110 degrees.

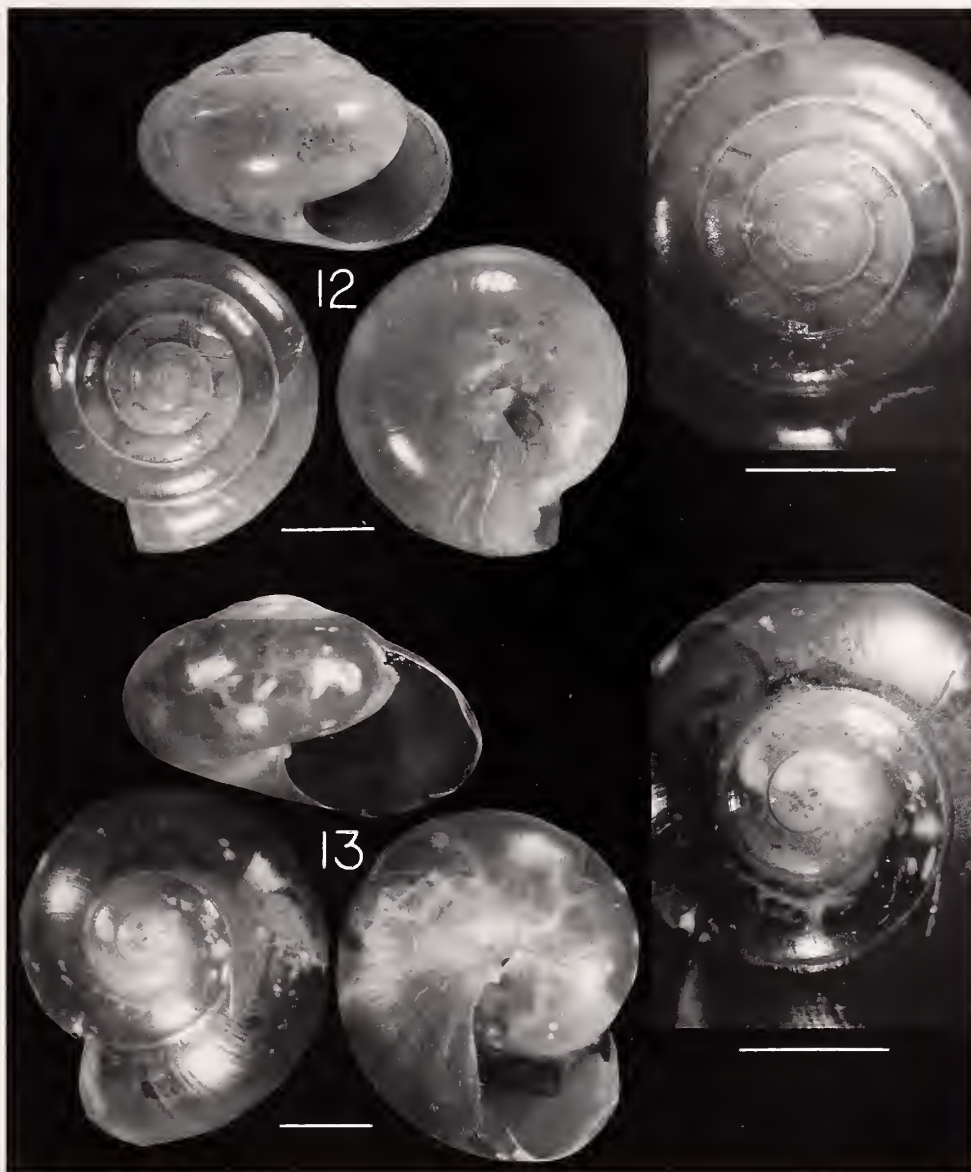
Apex. First whorl diameter 0.6 mm. First two whorls diameter 1.1 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth, no sculpture other than weak, irregularly spaced growth wrinkles.

Variation: No conspicuous variation in size or shape.

Comparisons: Extremely similar to *Microcystis sahavondrononae* Emberton, 1994, but even smaller and more tightly coiled, with 4.8 whorls producing a diameter of 3.3 mm, whereas 4.5 whorls produce 3.7 mm in the latter. Also lacking the spiral sculpture of *M. sahavondrononae*. Much smaller and more tightly coiled than *M. anosiana* Fischer-Piette, Blanc, Blanc & Salvat, 1994, and with a straight columellar insertion (angled about 30 degrees in *M. anosiana*).

Distribution: Mt. Mahermana, 100 to 200 m elevation.



Figures 12 and 13

Figure 12. *Microcystis andriamahajai* Emberton & Pearce, sp. nov., holotype. Figure 13. *Microcystis blanci* Emberton & Pearce, sp. nov., holotype. All scale bars 1 mm.

Etymology: For Dr. Benjamin Andriamahaja, National Director of the Ranomafana National Park Project.

Microcystis blanci Emberton & Pearce sp. nov.
(Figure 13)

Microcystis sp. 09, Emberton et al., 1996:210. Emberton, 1997:1148.

Holotype: USNM 860826 (ex MBI 380.03DH, Tol-8, ad shell; body included in MBI 380.03AP).

Paratypes: MBI 380.03DP (0; AMS C.203469 [1 ad]), MBI 380.03AP (4 ad, 1 juv).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: west of village of Mahialambo: south slope of Mt. Ilapiry, 300 m, 24°51'36"S, 47°00'40"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 3.8 mm; height 2.4 mm. Height-diameter ratio 0.63. Whorls 3.4. Coiling

tightness (whorl number divided by natural logarithm of shell diameter) 2.5. Spire angle 135 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 1.2% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 1.8% of shell diameter. Umbilicus 2% of shell diameter. Shell color pale yellow-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 48% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.91. Distance between the columellar and upper peristome insertions 78% of aperture width. Penultimate whorl projects into body whorl, occupying 27% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 105 degrees.

Apex. First whorl diameter 0.7 mm. First two whorls diameter 1.4 mm. Embryonic sculpture smooth then with weak growth wrinkles.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; incised lines extremely fine, more than 30 lines between sutures.

Comparisons: Unique for its relatively huge aperture. Similar in shape and fragility to *Microcystis charpentieri* Fischer-Piette, Blanc, Blanc & Salvat, 1994, but with looser coiling and a much smaller adult size (3.8 mm, 3.4 whorls vs. 5.4 mm, 5 whorls).

Distribution: Vohimena chain (Mts. Mahermana and Ilapiry), 100–300 m elevation.

Etymology: For Dr. Charles P. Blanc, a researcher of Madagascar's land snails.

Microcystis subangulata Emberton & Pearce, sp. nov.

(Figure 14)

Microcystis sp. 10, Emberton et al., 1996:210. Emberton, 1997:1148.

Holotype: USNM 860827 (ex MBI 383.03DH, Tol-11, ad).

Paratypes. MBI 382.19DP (1 ad, 1 juv).

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: northeast of village of Esetra: southeast slope of Mt. Vasiha, 700 m, 24°55'23"S, 46°44'27"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 2.2 mm; height 1.2 mm. Height-diameter ratio 0.54. Whorls 3.8. Coiling

tightness (whorl number divided by natural logarithm of shell diameter) 4.8. Spire angle 135 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 0.8% of shell diameter. Umbilicus 10% of shell diameter. Shell color white.

Aperture. Lower peristome angle where it meets parietal wall (apertural view) 105 degrees.

Apex. First whorl diameter 0.3 mm. First two whorls diameter 0.7 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; about 15 fine incised lines between sutures.

Variation: The largest specimen is from station MBI 382. It has 4.5 whorls and measures 2.6 mm in diameter.

Comparisons: Remarkable for its extremely small size and tight coiling. In these it is matched only by *Microcystis vohimenoidea* sp. nov., which has a much more elevated shell (height/diameter 0.7 vs. 0.5).

Distribution: Mt. Vasiha, 700 to 860 m elevation.

Etymology: For the somewhat (L. *sub*-, under) angulate (L. *angul*-) shell periphery.

Microcystis mahermanae Emberton & Pearce, sp. nov.

(Figure 15)

Microcystis sp. 11, Emberton et al., 1996:210. Emberton, 1997:1148.

Holotype: USNM 860828 (ex MBI 382. 05DH, Tol-10, ad).

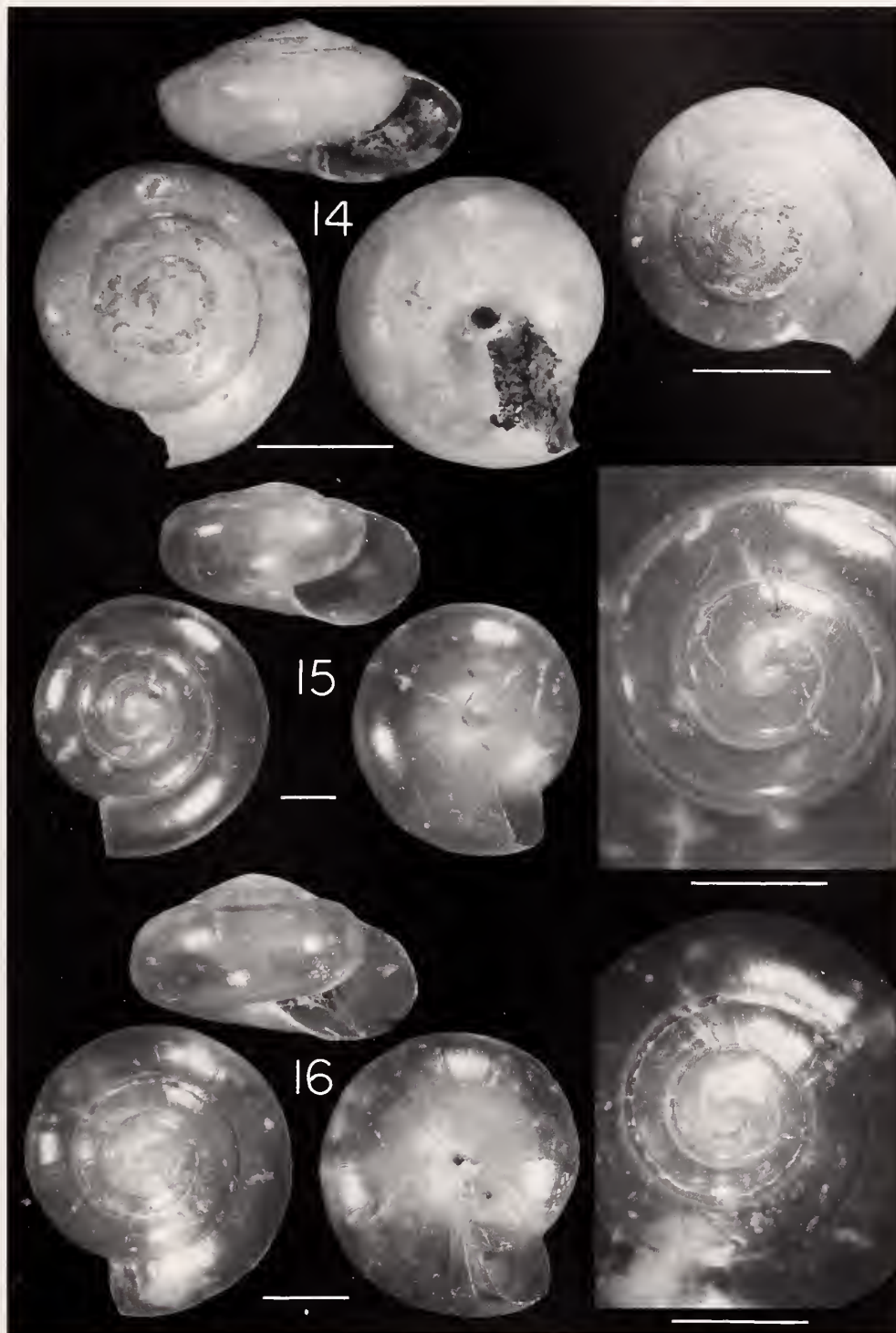
Paratypes: None.

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: west of village of Malio: Lower, south summit of Mt. Vasiha, 860 m, 24°55'18"S, 46°44'9"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 4.7 mm; height 2.6 mm. Height-diameter ratio 0.55. Whorls 4.2. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.7. Spire angle 150 degrees. Shell not domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 0.8% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 2.4% of shell diameter. Umbilicus 12% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions)



Figures 14–16

Figure 14. *Microcystis subangulata* Emberton & Pearce, sp. nov., holotype. Figure 15. *Microcystis mahermanae* Emberton & Pearce, sp. nov., holotype. Figure 16. *Microcystis basampla* Emberton & Pearce, sp. nov., holotype. All scale bars 1 mm.

49% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.76. Distance between the columellar and upper peristome insertions 76% of aperture width. Penultimate whorl projects into body whorl, occupying 30% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 95 degrees.

Apex. First whorl diameter 0.9 mm. First two whorls diameter 1.7 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; incised lines extremely fine, more than 30 lines between sutures.

Comparisons: Resembles *Microcystis argueyrolli* Fischer-Piette, Blanc, Blanc & Salvat, 1994, but with considerably looser coiling (2.7 vs. 2.3) and a much larger umbilicus (12% vs. 0% of shell diameter).

Distribution: Mt. Vasiha, 860 m elevation.

Etymology: For Mount Mahermana, northern Vohimana Chain.

Microcystis basampla Emberton & Pearce, sp.
nov.

(Figure 16)

Microcystis sp. 12, Emberton et al., 1996:210. Emberton, 1997:1148.

Holotype: USNM 860829 (ex MBI 382.06DH, Tol-10, ad).

Paratypes: None.

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: northeast of village of Esetra: Lower, south summit of Mt. Vasiha, 860 m, 24°55'18"S, 46°44'19"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 3.3 mm; height 2.0 mm. Height-diameter ratio 0.59. Whorls 4.4. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 3.7. Spire angle 130 degrees. Shell not domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 0.8% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 2.2% of shell diameter. Umbilicus 6% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 46% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.75. Distance

between the columellar and upper peristome insertions 83% of aperture width. Penultimate whorl projects into body whorl, occupying 32% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 50 degrees.

Apex. First whorl diameter 0.6 mm. First two whorls diameter 1.0 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; incised lines extremely fine, more than 30 lines between sutures.

Comparisons: Unique for its upper-peripherally flattened whorl. Otherwise its shape is most similar to that of *Microcystis arnali* Fischer-Piette, Blanc, Blanc & Salvat, 1994, which is very much larger and more loosely coiled.

Distribution: Mt. Vasiha, 860 m elevation.

Etymology: For the shell being widest (*L. ampli-*, spacious) near the base (*L. bas-*).

Family HELICARIONIDAE: Subfamily ARIOPHANTINAE
Genus *Kalidos* Gude, 1911

Kalidos balstoni (Angas, 1877)

(Figure 17)

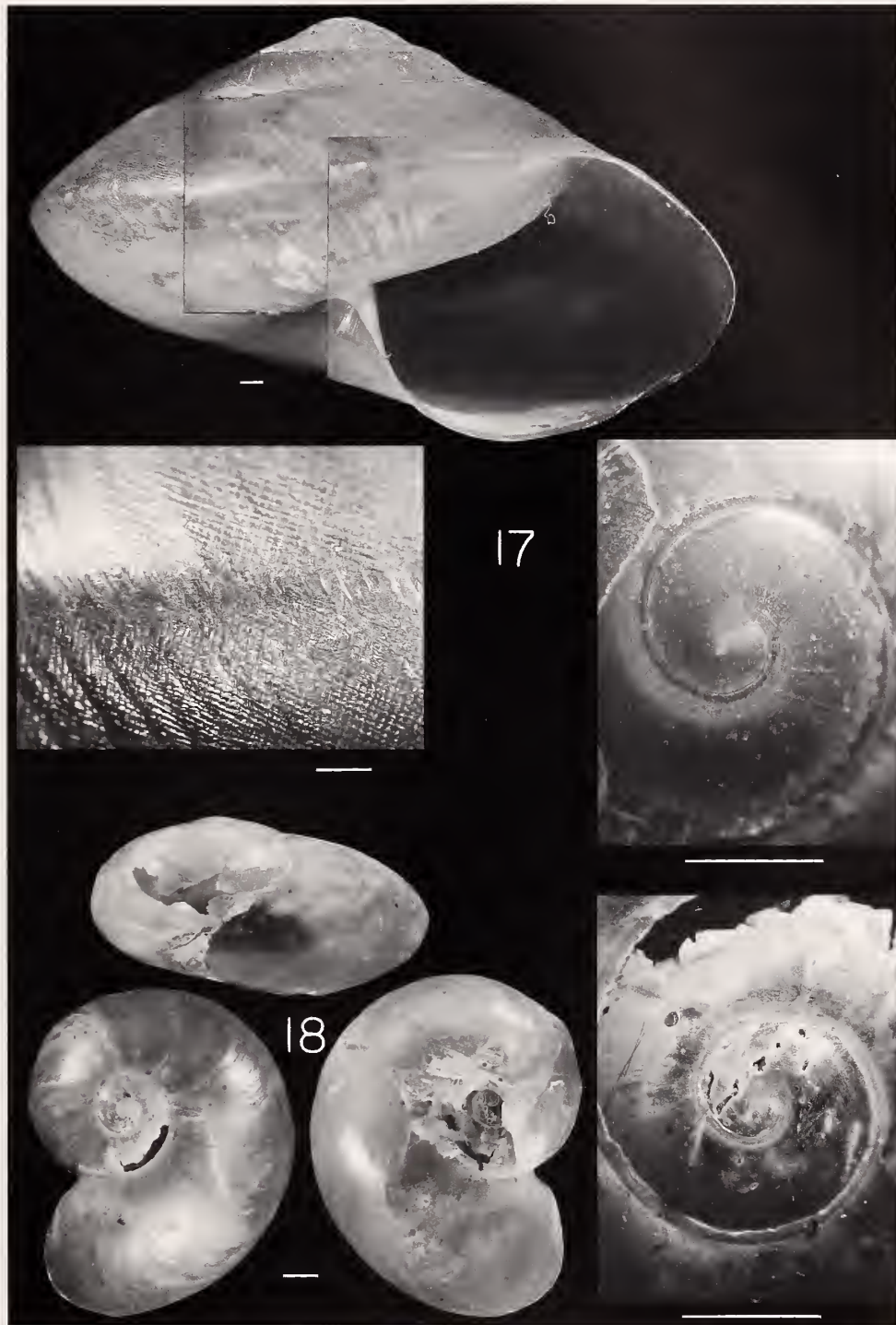
Kalidos sp. 01, Emberton et al., 1996:210. Emberton, 1997: 1146, 1150.

Representative: MBI 373.12DR, Tol-1 (ad).

Other specimens: MBI 373.12D (13 juv), MBI 373.12A (7 ad, 1 juv), MBI 374.22D (1 ad, 2 juv), MBI 374.22A (1 ad, 6 juv), MBI 375.20D (1 ad, 8 juv), MBI 375.20A (14 ad, 2 juv), MBI 376.14D (5 juv), MBI 377.18D (7 juv), MBI 377.18A (3 juv), MBI 378.16D (4 juv), MBI 378.16A (2 ad, 4 juv), MBI 379.25D (1 ad, 7 juv), MBI 380.18D (1 ad, 12 juv), MBI 380.18A (6 ad, 4 juv), MBI 381.18D (1 ad, 3 juv; AMS C.203470 [1 ad]; MNHN [1 ad]; ANSP 400843 [1 ad]), MBI 381.18A (1 juv), MBI 382.20D (1 juv), MBI 383.12D (7 juv), MBI 383.12A (3 ad), MBI 384.16D (1 juv), MBI 384.16A (1 ad, 1 juv), MBI 385.13D (1 juv), MBI 389.02A (9 ad, 2 juv), MBI 390.04D (3 juv), MBI 390.04A (1 juv), MBI 392.01A (1 ad).

Description of representative:

Shell Size and Shape. Diameter 31.6 mm; height 18.9 mm. Height-diameter ratio 0.60. Whorls 5.4. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 1.6. Spire angle 125 degrees. Shell not domed. Whorl periphery angular with or without a keel. Suture depth one half whorl from aperture is 0.5% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell;



Figures 17 and 18

Figure 17. *Kalidos balstoni* (Angas, 1877), representative from summit of Mt. Mahermana. Figure 18. *Malagarion tillieri* Emberton & Pearce, sp. nov., holotype. All scale bars 1 mm.

width from suture to sub-sutural line (apical view) 0.2% of shell diameter. Umbilicus 5% of shell diameter. Shell color red-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 48% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.75. Distance between the columellar and upper peristome insertions 79% of aperture width. Penultimate whorl projects into body whorl, occupying 17% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 95 degrees.

Apex. First whorl diameter 1.7 mm. First two whorls diameter 4.2 mm. Embryonic sculpture of weak spiral ridges and weak transverse ribs.

Post-Embryonic Shell Sculpture. Post-embryonic shell with forwardly ascending, closely spaced incised spiral lines cross-cut perpendicularly by incised transverse lines giving the appearance of woven fabric, and with weaker, regularly spaced growth ribs not parallel to either set of incised lines.

Variation: No conspicuous variation in size or shape.

Distribution: Mts. Mahermana, Ilapiry, and Vasiha at 100 to 860 m elevation (this paper), and widespread in the central, southern, and eastern part of Madagascar (Fischer-Piette et al., 1994).

Kalidos richardi Emberton & Pearce, sp. nov.

(Figures 19, 20)

Kalidos sp. 02, Emberton et al., 1996:210. Emberton, 1997: 1146, 1150.

Holotype: USNM 860830 (ex MBI 374.03DH, Tol-2, ad).

Paratypes: MBI 373.19DP (1 juv), MBI 374.03DP (1 ad, 1 juv; AMS C. 203471 [1 ad]; MNHN [1 ad]; ANSP 400844 [1 ad]), MBI 376.15DP (1 juv).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: northeast of village of Esetra: WSW slope of Mt. Mahermana, 300 m, 24°26'17"S, 47°13'10"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 11.6 mm; height 7.3 mm. Height-diameter ratio 0.64. Whorls 4.9. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.0. Spire angle 125 degrees. Shell not domed. Whorl periphery angular with or without a keel. Suture depth one half whorl from aperture is 1.4% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 0.2%

of shell diameter. Umbilicus 8% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 50% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.70. Distance between the columellar and upper peristome insertions 86% of aperture width. Penultimate whorl projects into body whorl, occupying 23% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 70 degrees.

Apex. First whorl diameter 1.2 mm. First two whorls diameter 2.8 mm. Embryonic sculpture of about 30 spiral ridges.

Post-Embryonic Shell Sculpture. Post-embryonic shell with very fine, regularly spaced, crowded transverse lines.

Variation: The largest shell measures 13.3 mm in diameter, with 5.2 whorls (station MBI 374).

Comparisons: Nearly identical in size, shape, and coiling tightness to *Kalidos prenanti* Fischer-Piette, Blanc, Blanc & Salvat, 1994, but with very different embryonic sculpture of dense spiral grooves (vs. transversely, then spirally aligned granules) and post-embryonic smooth, featureless sculpture (vs. cross-hatched riblets), and with a weaker peripheral carination.

Distribution: Mts. Mahermana and Vasiha, 100–860 m elevation.

Etymology: For our guide, collector, and friend, Richard Ialy of Esetra.

Kalidos zahamenensis Fischer-Piette, Blanc, Blanc & Salvat, 1994

(Figures 21, 22)

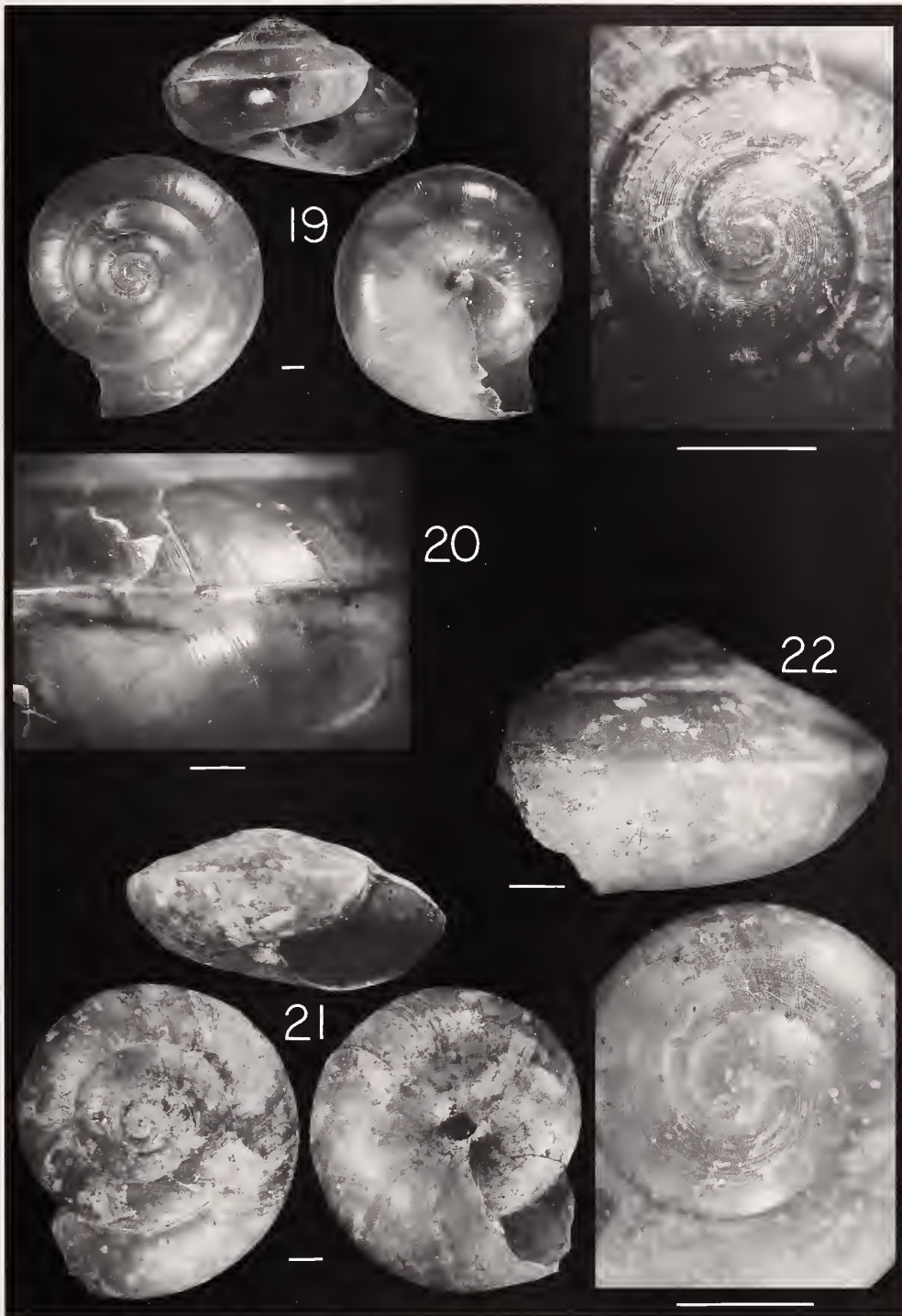
Kalidos sp. 03, Emberton et al., 1996:210. Emberton, 1997: 1147, 1150.

Representative: MBI 378.05DR, Tol-6 (ad).

Other specimens: MBI 376.16D (1 ad, 3 juv; AMS C. 203472 [1 ad]), MBI 379.26D (1 juv), MBI 381.19D (1 juv).

Description of representative:

Shell Size and Shape. Diameter 9.2 mm; height 4.7 mm. Height-diameter ratio 0.51. Whorls 5.0. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.3. Spire angle 140 degrees. Shell not domed. Whorl periphery angular with or without a keel. Suture depth one half whorl from aperture is 1.1% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 1.5%



Figures 19–22

Figures 19, 20. *Kalidos richardi* Emberton & Pearce, sp. nov., holotype. Figures 21, 22. *Kalidos zahamenensis* Fischer-Piette, Blanc, Blanc & Salvat, 1994, representative from Mt. Ilapiry at 500 m. All scale bars 1 mm.

of shell diameter. Umbilicus 10% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 47% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.67. Distance between the columellar and upper peristome insertions 81% of aperture width. Penultimate whorl projects into body whorl, occupying 24% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 75 degrees.

Apex. First whorl diameter 1.1 mm. First two whorls diameter 2.4 mm. Embryonic sculpture of about 30 spiral ridges.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; about 15 fine incised lines between sutures.

Variation: The largest of the specimens reported here has 4.8 whorls, with a diameter of 11.3 mm (station MBI 376).

Comparisons: Smaller for the same number of whorls than *Kalidos lapillus* Fischer-Piette & Bedoucha, 1966; *K. anobrachys* (Dohrn, 1882); *K. prenanti* Fischer-Piette, Blanc, Blanc & Salvat, 1994; *K. montis* Fischer-Piette & Bedoucha, 1966; and *K. guernesti* Fischer-Piette, Blanc, Blanc & Salvat, 1994. More densely and lightly striate than, and more depressed and less carinate than, *K. fallax* Fischer-Piette, Blanc & Salvat, 1975.

Distribution: Vohimena chain (Mts. Mahermana and Ilapiry) from 100 to 500 m elevation (this paper), and from Zahamena, east-central Madagascar (Fischer-Piette et al., 1994).

Kalidos prenanti

Fischer-Piette, Blanc, Blanc & Salvat, 1994

(Figures 23, 24)

Kalidos sp. 04, Emberton et al., 1996:210. Emberton, 1997: 1147, 1150.

Representative: MBI 380.04DR, MBI 380.04AR, Tol-8 (ad).

Other specimens: MBI 379.27D (1 ad, 2 juv), MBI 380.04D (1 juv; AMS C.203473 [1 ad]), MBI 380.04A (3 juv), MBI 385.18A (1 juv).

Description of representative:

Shell Size and Shape. Diameter 10.8 mm; height 6.8 mm. Height-diameter ratio 0.63. Whorls 5.3. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.2. Spire angle 130 degrees. Shell moderately domed. Whorl periphery angular with or without

a keel. Suture depth one half whorl from aperture is 0.6% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 0.4% of shell diameter. Umbilicus 2% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 48% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.64. Distance between the columellar and upper peristome insertions 82% of aperture width. Penultimate whorl projects into body whorl, occupying 20% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 75 degrees.

Apex. First whorl diameter 1.2 mm. First two whorls diameter 2.6 mm. Embryonic sculpture of spiral ridges then also with forward-descending small ribs.

Post-Embryonic Shell Sculpture. Post-embryonic shell with forwardly ascending, closely spaced incised spiral lines cross-cut perpendicularly by incised transverse lines giving the appearance of woven fabric, and with weaker, regularly spaced growth ribs not parallel to either set of incised lines.

Variation: The largest specimen reported here was from MBI 379: diameter 11.5 mm, whorls 5.4. The single juvenile specimen from the distant station MBI 385 has similar sculpture, but larger embryonic whorls and a greater rate of whorl expansion; probably it is a different, undescribed species.

Distribution: Mt. Ilapiry, 300 to 400 m elevation (this paper), and Ambodiriakely forest near Andringitra Reserve (Fischer-Piette et al., 1994).

Comments: With a weak carina more similar to *Kalidos torfani* Fischer-Piette, Blanc, Blanc & Salvat, 1994, of which this species is probably a synonym.

Kalidos fenni Emberton & Pearce, sp. nov.

(Figures 25, 26)

Kalidos sp. 05, Emberton et al., 1996:210. Emberton, 1997: 1147.

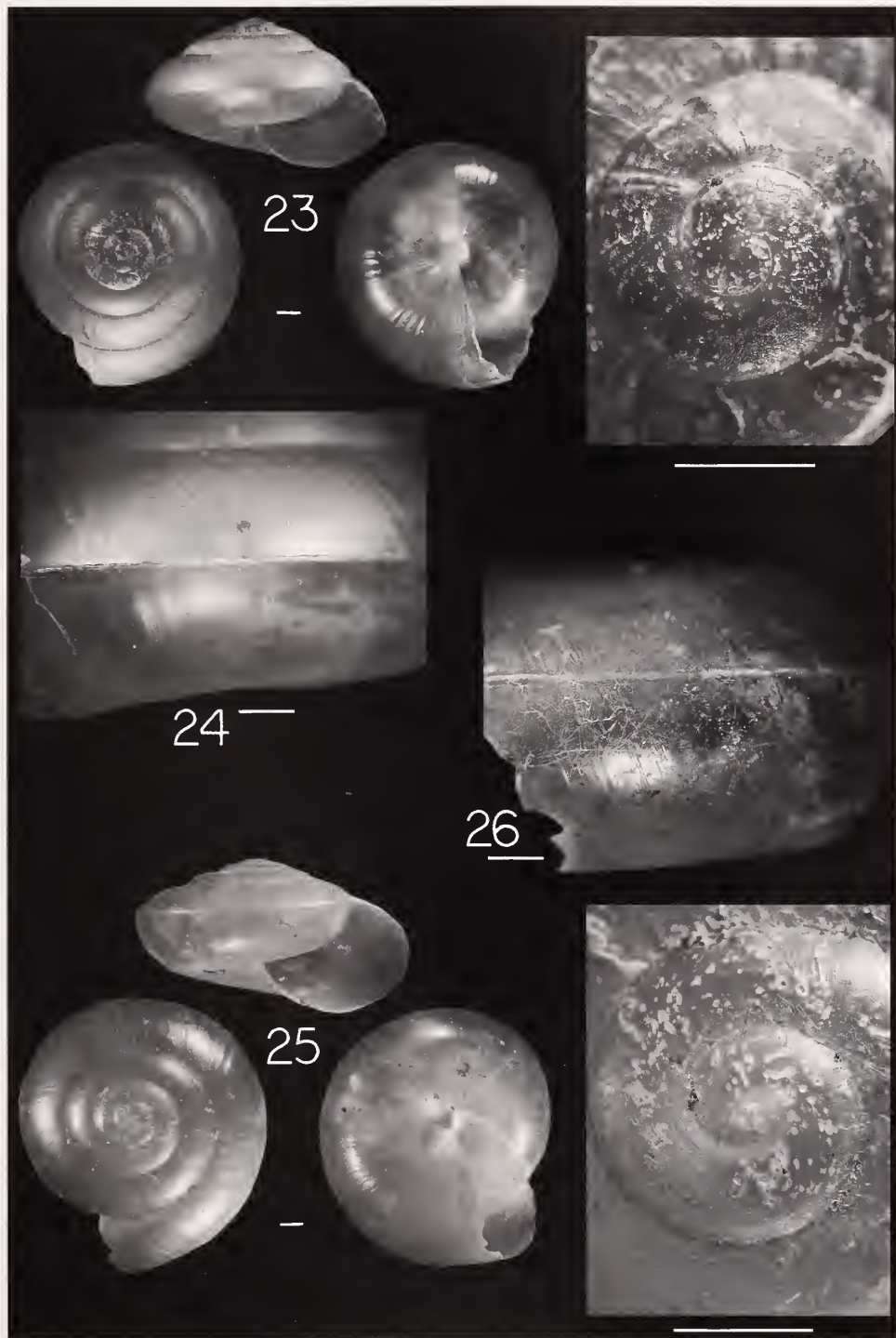
Holotype: USNM 860831 (ex MBI 379.05DH, Tol-7, ad).

Paratypes: MBI 379.05DP (6 juv; AMS C.203474 [1 ad]), 380.19DP (1 juv).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: west of village of Mahialambo: Ridge, valley, and slope on southsoutheast face of Mt. Ilapiry, 400 m, 24°51'27"S, 47°00'38"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 12.2 mm; height 7.0



Figures 23–26

Figures 23, 24. *Kalidos prenanti* Fischer-Piette, Blanc, Blanc & Salvat, 1994, representative from Mt. Ilapiry at 300 m. Figures 25, 26. *Kalidos fenni* Emberton & Pearce, sp. nov., holotype. All scale bars 1 mm.

mm. Height-diameter ratio 0.57. Whorls 4.8. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 1.9. Spire angle 135 degrees. Shell not domed. Whorl periphery angular with or without a keel. Suture depth one half whorl from aperture is 1.7% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 0.3% of shell diameter. Umbilicus 2% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 47% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.76. Distance between the columellar and upper peristome insertions 78% of aperture width. Penultimate whorl projects into body whorl, occupying 25% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 75 degrees.

Apex. First whorl diameter 1.2 mm. First two whorls diameter 2.8 mm. Embryonic sculpture of weak spiral ridges then also with weak growth wrinkles.

Post-Embryonic Shell Sculpture. Post-embryonic shell with very fine, regularly spaced, crowded transverse lines.

Comparisons: Somewhat similar to both *Kalidos bernardi* Fischer-Piette, Blanc, Blanc & Salvat, 1994, and *K. helleri* Fischer-Piette, Blanc, Blanc & Salvat, 1994, but lacks the distinct body-whorl sculpture of each and has a proportionately smaller aperture than both. Neither of the latter has this species' diagnostic embryonic sculpture of dense spiral ridges. More loosely coiled and larger than the very similar *K. vasihae* sp. nov., and lacking its embryonic sculpture of beaded spiral ridges.

Distribution: Mt. Ilapiry, 400 m elevation.

Etymology: For Marc Fenn, World Wide Fund for Nature, Fort Dauphin.

Kalidos striaspiralis Emberton & Pearce, sp. nov.

(Figure 27)

Kalidos sp. 06, Emberton et al., 1996:210. Emberton, 1997: 1147.

Holotype: USNM 860832 (ex MBI 377.04DH, Tol-5, ad).

Paratypes: MBI 377.04DP (1 juv), MBI 378.17DP (1 ad, 1 juv), MBI 379.28DP (0; AMS C.203475 [1 ad]), MBI 380.20DP (3 juv), MBI 381.20DP (2 juv).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: west of village of Mahialambo: Summit of Mt. Ilapiry, 540 m, 24°51'40"S, 47°00'20"E: primary rain-forest.

Description of holotype:

Shell Size and Shape. Diameter 9.5 mm; height 5.1 mm. Height-diameter ratio 0.54. Whorls 5.2. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.3. Spire angle 130 degrees. Shell slightly domed. Whorl periphery angular with or without a keel. Suture depth one half whorl from aperture is 1.1% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 1.3% of shell diameter. Umbilicus 10% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 45% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.64. Distance between the columellar and upper peristome insertions 73% of aperture width. Penultimate whorl projects into body whorl, occupying 22% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 105 degrees.

Apex. First whorl diameter 1.0 mm. First two whorls diameter 1.9 mm. Embryonic sculpture of beaded spiral ridges.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; about 20 fine incised lines between sutures.

Variation: Largest specimen: diameter 12.3 mm, whorls 5.0 (MBI 379).

Comparisons: Similar in shape to *Kalidos decaryi* Fischer-Piette, Blanc & Salvat, 1975, and *K. propeanobrachis* Fischer-Piette & Bedoucha, 1966, but with much tighter coiling than either. Very distinctive for its sculpture of strongly incised spiral grooves and its large umbilicus.

Distribution: Mt. Ilapiry, 200 to 540 m elevation.

Etymology: For the spiral (L. *spiro*-) striae (L. *striat*-) on the shell.

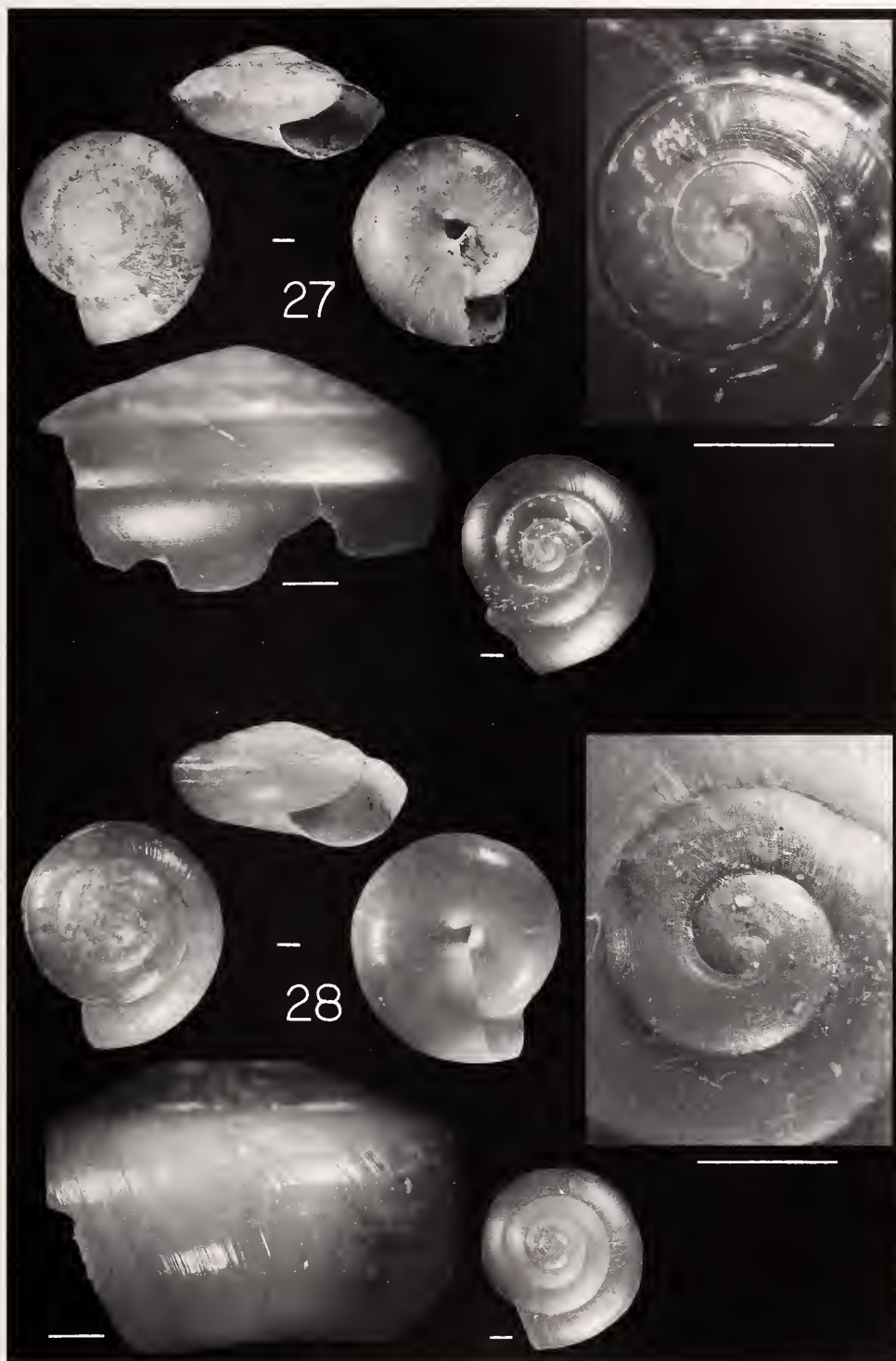
Kalidos vasihae Emberton & Pearce, sp. nov.

(Figure 28)

Kalidos sp. 07, Emberton et al., 1996:210. Emberton, 1997: 1146, 1150.

Holotype: USNM 860833 (ex MBI 382.07DH, Tol-10, ad).

Paratypes: MBI 382.07DP (1 ad, 6 juv; AMS C.203476 [1 ad]; MNHN [1 ad]), MBI 382.07AP (4 juv), MBI 383.13DP (2 ad, 3 juv; ANSP 400845 [1 ad]), MBI



Figures 27 and 28

Figure 27. *Kalidos striaspiralis* Emberton & Pearce, sp. nov., holotype (three views) and broken paratype MBI 380.20DP (two apical and one side view). Figure 28. *Kalidos vasihae* Emberton & Pearce, sp. nov., holotype (three views and enlarged side view) and paratype MBI 386.11DP (two apical views). All scale bars 1 mm.

385.14DP (2 ad, 1 juv), MBI 385.14AP (1 juv), MBI 386.11DP (1 juv).

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: northeast of village of Esetra: lower, south summit of Mt. Vasiha, 860 m, 24°55'18"S, 46°44'19"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 10.6 mm; height 4.8 mm. Height-diameter ratio 0.46. Whorls 5.2. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.2. Spire angle 140 degrees. Shell slightly domed. Whorl periphery angular with or without a keel. Suture depth one half whorl from aperture is 0.6% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 0.4% of shell diameter. Umbilicus 1% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 46% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.68. Distance between the columellar and upper peristome insertions 87% of aperture width. Penultimate whorl projects into body whorl, occupying 26% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 65 degrees.

Apex. First whorl diameter 1.0 mm. First two whorls diameter 2.2 mm. Embryonic sculpture of beaded spiral ridges.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth with extremely fine incised spiral lines and weak, irregular growth wrinkles, sculpture on shell base as on upper parts of shell; incised lines extremely fine, more than 30 lines between sutures.

Variation: No conspicuous variation in size or shape. Another specimen from the holotype's station (MBI 382) is just under it in size: diameter 10.5 mm, whorls 4.7.

Comparisons: More tightly coiled and smaller than the very similar *K. fenni* sp. nov., which lacks this species' embryonic sculpture of beaded spiral ridges.

Distribution: Mt. Vasiha, 400 to 860 m elevation.

Etymology: For Mount Vasiha, southern Anosy Mountain Chain.

Genus *Malagarion* Tillier, 1979

Malagarion tillieri Emberton & Pearce, sp. nov.

(Figure 18)

Malagarion sp. 01, Emberton et al., 1996:210. Emberton, 1997:1147, 1150.

Holotype: USNM 860834 (ex MBI 386. 05DH, ToI-14, ad).

Paratypes: MBI 376.25AP (1 ad), MBI 382.25DP (1 juv), MBI 383.15DP (1 juv; MNHN [1 ad]), MBI 383.15AP (1 juv), MBI 384.17DP (2 juv), MBI 386.05DP (1 juv; AMS C.203477 [1 ad]), MBI 386.05AP (1 ad), MBI 387.12DP (3 juv), MBI 390.07AP (1 juv).

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: northeast of village of Esetra: south-southeast slope of Mt. Vasiha, 300 m, 24°55'37"S, 46°44'49"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 9.7 mm; height 5.6 mm. Height-diameter ratio 0.58. Whorls 3.8. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 1.7. Spire angle 155 degrees. Shell not domed. Whorl periphery rounded to slightly angular, no presutural ridge. Suture depth one half whorl from aperture is 0.4% of shell diameter. Sub-sutural line (where inside of shell wall meets previous whorl) visible through translucent shell; width from suture to sub-sutural line (apical view) 1.2% of shell diameter. Shell color pale yellow-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 53% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.96. Distance between the columellar and upper peristome insertions 149% of aperture width. Penultimate whorl projects into body whorl, occupying 24% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 165 degrees.

Apex. First whorl diameter 1.2 mm. First two whorls diameter 1.4 mm. Embryonic sculpture of weak spiral striae.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth, no sculpture other than weak, irregularly spaced growth wrinkles.

Variation: The largest specimen (diameter 10.4 mm) is from station MBI 386.

Comparisons: Shell shape very similar to *Chlamydarion* (?) *grili* Fischer-Piette, Blanc, Blanc & Salvat, 1994, but lacks fine spiral striae of that species and is smaller for the same whorl number. Similar in size and shape to *Malagarion antalahae* Emberton, 1994, but lacks sculpture of that species. Lacks the shallow spiral groove in the upper periphery of *Malagarion andampibei* Emberton, 1994, and is smaller at the same whorl number. Upper whorls not whitish as in *Malagarion andranomenae* Emberton, 1994, and is smaller at the same whorl number, mantle covers less of the shell, and lacks warty protuberances of that species. Final whorl not ascending on

previous whorl as in *Chlamydarion* (?) *puitsi* Fischer-Piette, Blanc, Blanc & Salvat, 1994.

Distribution: Mts. Mahermana and Mt. Vasiha, 100–860 m elevation.

Etymology: For Dr. Simon Tillier, Musée Nationale d'histoire Naturelle, Paris, who first described and named the genus.

Family HELICARIONIDAE: Subfamily
MACROCHLAMYDINAE

Genus *Sitala* H. Adams, 1865

Sitala josephinae Emberton & Pearce, sp. nov.

(Figure 29)

Sitala sp. 01, Emberton et al., 1996:210, Emberton, 1997: 1146, 1150.

Holotype: USNM 860835 (ex MBI 375.21DH, Tol-3, ad).

Paratypes: MBI 373.20DP (7 juv; AMS C.203478 [1 ad]; MNHN [1 ad]), MBI 373.20AP (1 juv), MBI 374.23DP (3 juv), MBI 374.23AP (1 ad), MBI 375.21DP (1 ad, 1 juv; ANSP 400846 [1 ad]), MBI 375.21AP (2 ad), MBI 376.17DP (1 ad).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: northeast of village of Esetra: west slope of Mt. Mahermana, 200 m, 24°26'15"S, 47°13'04"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 4.5 mm; height 4.6 mm. Height-diameter ratio 1.03. Whorls 6.3. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 4.2. Spire angle 80 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, pre-sutural ridge present. Suture depth one half whorl from aperture is 2.9% of shell diameter. Umbilicus 6% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 48% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.62. Distance between the columellar and upper peristome insertions 82% of aperture width. Penultimate whorl projects into body whorl, occupying 7% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 100 degrees.

Apex. First whorl diameter 0.5 mm. First two whorls diameter 1.0 mm. Embryonic sculpture of three spiral ridges.

Post-Embryonic Shell Sculpture. Post-embryonic shell with three carinae between sutures; with very weak spiral

ridges between the carinae, about 10 spiral ridges from the upper suture to the first carina, about seven spiral ridges to the next carina, and about five spiral ridges to the third. Shell base smooth.

Variation: No conspicuous variation in size or shape. The largest specimen (station MBI 373) has 6.8 whorls and a height of 5.3 mm.

Comparisons: Most similar to *Sitala brancsiki* Boettger, 1892, in shape and sculpture, both having numerous weaker spiral ridges between stronger spiral ridges, but *S. brancsiki* has four spiral ridges instead of three, and its ridges are stronger.

Distribution: Mt. Mahermana, 100 to 340 m elevation.

Etymology: For Josephine Djaohasara Emberton, wife of KCE.

Sitala elegans Emberton & Pearce, sp. nov.

(Figure 30)

Sitala sp. 02, Emberton et al., 1996:210, Emberton, 1997: 1148, 1150.

Holotype: USNM 860836 (ex MBI 379.06DH, Tol-7, ad).

Paratypes: MBI 379.06DP (2 juv; AMS C.203479 [1 ad]), MBI 379.06AP (4 ad).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: west of village of Mahialambo: Ridge, valley, and slope on southsoutheast face of Mt. Ilapiry, 400 m, 24°51'27"S, 47°00'38"E: primary rainforest.

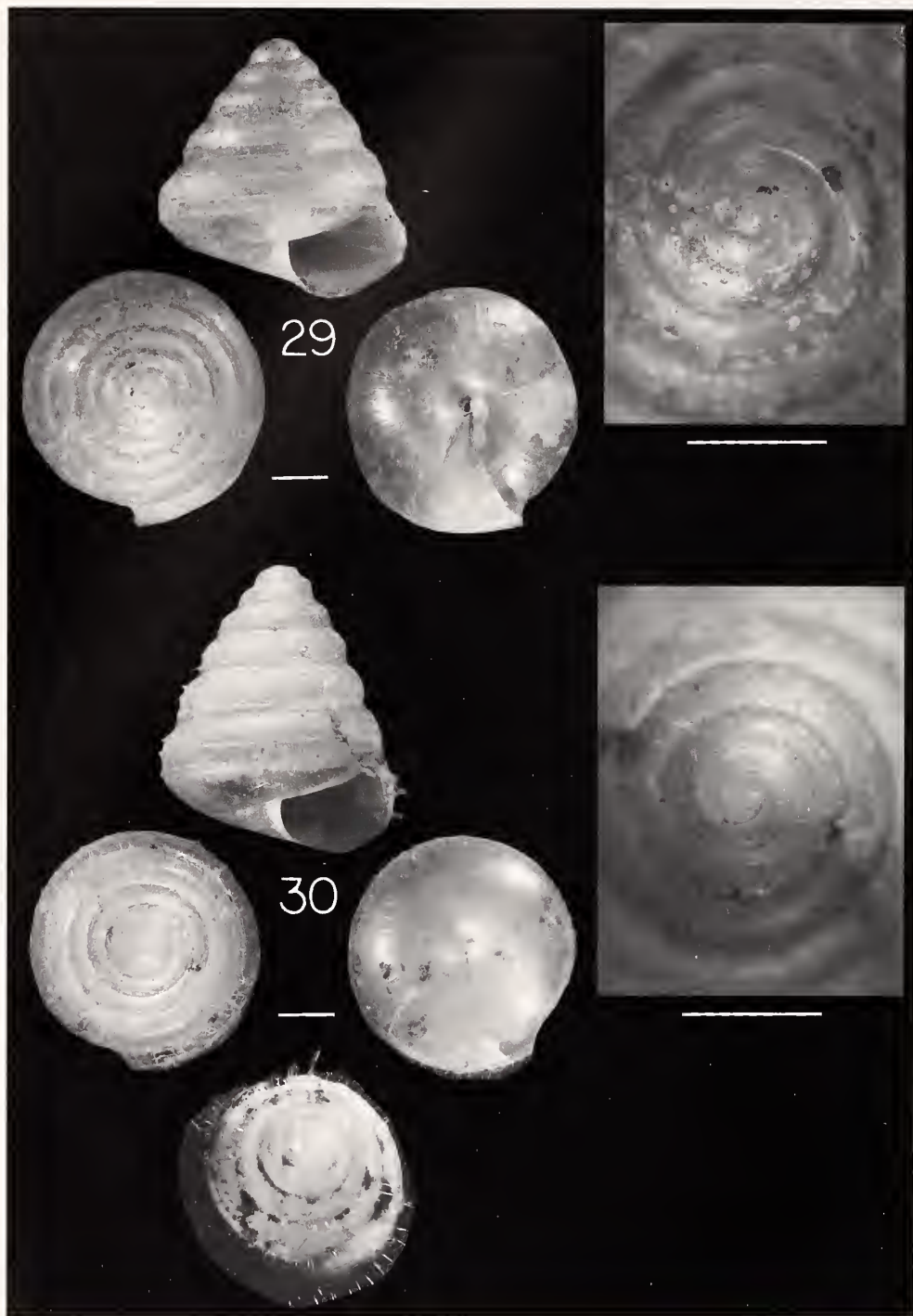
Description of holotype:

Shell Size and Shape. Diameter 4.2 mm; height 5.2 mm. Height-diameter ratio 1.24. Whorls 6.6. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 4.6. Spire angle 65 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, pre-sutural ridge present. Suture depth one half whorl from aperture is 2.4% of shell diameter. Umbilicus 1% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 47% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.68. Distance between the columellar and upper peristome insertions 87% of aperture width. Penultimate whorl projects into body whorl, occupying 12% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 105 degrees.

Apex. First whorl diameter 0.8 mm. First two whorls diameter 1.3 mm. Embryonic sculpture of three interrupted spiral ridges.

Post-Embryonic Shell Sculpture. Post-embryonic shell



Figures 29 and 30

Figure 29. *Sitala josephinae* Emberton & Pearce, sp. nov., holotype. Figure 30. *Sitala elegans* Emberton & Pearce, sp. nov., holotype. All scale bars 1 mm.

with three carinae between sutures; bristles present on all three carinae, about five bristles per carina in one-tenth of penultimate whorl; bristles about 0.8 mm long. Base of shell smooth.

Comparisons: Unique within the genus for its bristly sculpture.

Distribution: Mt. Ilapiry, 400 m elevation.

Etymology: For the elegant (*L. elegans*) sculpture and shape.

Sitala ilapiryae Emberton & Pearce, sp. nov.

(Figure 31)

Sitala sp. 03, Emberton et al., 1996:210. Emberton, 1997: 1148, 1150.

Holotype: USNM 860837 (ex MBI 379.07DH, Tol-7, ad).

Paratypes: MBI 379.07DP (1 ad, 4 juv; AMS C.203480 [1 ad]).

Type locality: Madagascar: Tulear Province: north of Fort Dauphin: west of village of Mahialambo: Ridge, valley, and slope on southsoutheast face of Mt. Ilapiry, 400 m, 24°51'27"S, 47°00'38"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 2.5 mm; height 2.0 mm. Height-diameter ratio 0.82. Whorls 4.2. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 4.6. Spire angle 85 degrees. Shell slightly domed. Whorl periphery rounded to slightly angular, presutural ridge present. Suture depth one half whorl from aperture is 2.4% of shell diameter. Umbilicus 4% of shell diameter. Shell color white.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 46% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.72. Distance between the columellar and upper peristome insertions 78% of aperture width. Penultimate whorl projects into body whorl, occupying 19% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 100 degrees.

Apex. First whorl diameter 0.6 mm. First two whorls diameter 1.1 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell smooth, no sculpture other than weak, irregularly spaced growth wrinkles.

Variation: No conspicuous variation in size or shape.

Comparisons: More squat than *Sitala amabilis* Fischer-Piette & Salvat, 1966, and *S. ankazobei* Fischer-Piette, Blanc, Blanc & Salvat, 1994, and lacking the spiral striae of the latter.

Distribution: Mt. Ilapiry, 400 m elevation.

Etymology: For Mount Ilapiry, southern Vohimena chain.

Sitala euconuliforma Emberton & Pearce, sp. nov.

(Figure 32)

Sitala sp. 04, Emberton et al., 1996:210. Emberton, 1997: 1148.

Holotype: USNM 860838 (ex MBI 384.04DH, Tol-12, ad).

Paratypes: MBI 382.21DP (1 ad, 1 juv; MNHN [1 ad]), MBI 385.15DP (1 ad, 1 juv; AMS C.203481 [1 ad]), MBI 386.12DP (3 juv).

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: northeast of village of Esetra: east slope of Mt. Vasiha, 500 m, 24°55'19"S, 46°44'45"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 3.4 mm; height 4.1 mm. Height-diameter ratio 1.18. Whorls 7.3. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 6.0. Spire angle 60 degrees. Shell moderately domed. Whorl periphery rounded to slightly angular, presutural ridge present. Suture depth one half whorl from aperture is 1.5% of shell diameter. Umbilicus 4% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 45% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.69. Distance between the columellar and upper peristome insertions 94% of aperture width. Penultimate whorl projects into body whorl, occupying 17% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 100 degrees.

Apex. First whorl diameter 0.7 mm. First two whorls diameter 1.1 mm. Embryonic sculpture smooth.

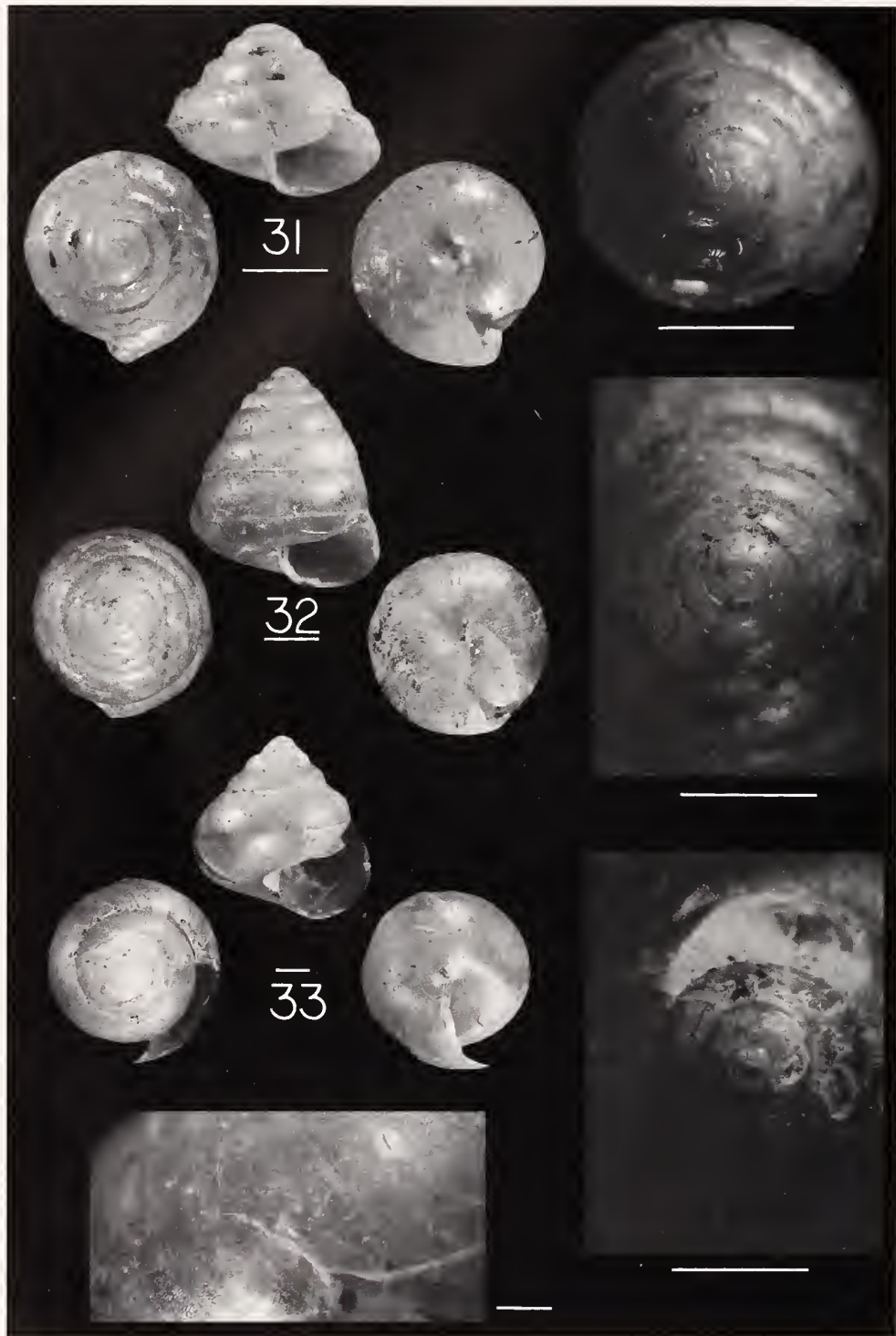
Post-Embryonic Shell Sculpture. Post-embryonic shell with very fine granulations. Periphery with a single strong spiral ridge, appearing in the suture as a thread.

Variation: No conspicuous variation in size or shape.

Comparisons: Has the sutural thread, lack of other spiral sculpture, and similar shape and whorl number as *Sitala filomarginata* Boettger, 1892, but this is smaller, a little less squat, and the carina is not wavy.

Distribution: Mt. Vasiha, 300 to 860 m elevation.

Etymology: For the shell shape (*L. forma*) resembling some North American *Euconulus* Reinhardt, 1883.



Figures 31-33

Figure 31. *Sitala ilapirya* Emberton & Pearce, sp. nov., holotype. Figure 32. *Sitala euconuliforma* Emberton & Pearce, sp. nov., holotype. Figure 33 *Sitala amabilis* Fischer-Piette & Salvat, 1966, representative from Mt. Vasiha at 500 m. All scale bars 1 mm.

Sitala gaudens Fischer-Piette & Salvat, 1966

(Figures 34, 35)

Sitala sp. 05, Emberton et al., 1996:210, 211. Emberton, 1997:1146, 1150.**Representative:** MBI 378.06DR, Tol-6 (ad).**Other specimens:** MBI 376.18D (1 juv), MBI 377.19D (2 ad, 20 juv; AMS C. 203482 [1 ad]; MNHN [1 ad]), MBI 377.19A (1 ad), MBI 378.06D (3 ad, 30 juv; ANSP 400847 [1 ad]), MBI 379.29D (1 ad, 3 juv), MBI 380.21D (1 juv).**Description of representative:**

Shell Size and Shape. Diameter 7.2 mm; height 7.2 mm. Height-diameter ratio 0.99. Whorls 5.9. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 3.0. Spire angle 80 degrees. Shell not domed. Whorl periphery rounded to slightly angular, pre-sutural ridge present. Suture depth one half whorl from aperture is 1.2% of shell diameter. Umbilicus 1% of shell diameter. Shell color pale yellow-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 53% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.74. Distance between the columellar and upper peristome insertions 84% of aperture width. Penultimate whorl projects into body whorl, occupying 19% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 105 degrees.

Apex. First whorl diameter 1.0 mm. First two whorls diameter 1.8 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell with fine, closely spaced, wavy, beaded spiral sculpture, about 40 spiral sculptures between sutures, sculpture continuing on shell base.

Variation: The largest specimen reported here (station MBI 377) has 6.2 whorls, height 9.1 mm, diameter 8.8 mm.

Distribution: Vohimena chain (Mts. Mahermana and Ilapiry), 100–540 m elevation (this paper), and Manjakatompoto forest in central Madagascar (Fischer-Piette et al., 1994).

Comments: The illustration of *Sitala gaudens* Fischer-Piette & Salvat, 1966, in Fischer-Piette et al. (1994:plate 43:7) is a shell having a more concave spire profile, and the description indicates that the spiral incised lines are weaker than the transverse lines (the opposite is true for this specimen).

Sitala amabilis Fischer-Piette & Salvat in Fischer-Piette, Bedoucha & Salvat, 1966

(Figure 33)

Sitala sp. 06, Emberton et al., 1996:210. Emberton, 1997:1146.**Representative:** MBI 384.05DR, Tol-12 (ad).**Other specimens:** MBI 382.22D (1 juv), MBI 384.05D (3 juv), MBI 388.10D (1 juv).**Description of representative:**

Shell Size and Shape. Diameter 5.2 mm; height 5.4 mm. Height-diameter ratio 1.03. Whorls 5.2. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 3.2. Spire angle 85 degrees. Shell not domed. Whorl periphery rounded to slightly angular, pre-sutural ridge present. Suture depth one half whorl from aperture is 1.9% of shell diameter. Umbilicus 3% of shell diameter. Shell color pale yellow-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 57% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.67. Distance between the columellar and upper peristome insertions 80% of aperture width. Penultimate whorl projects into body whorl, occupying 15% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 120 degrees.

Apex. First whorl diameter 0.8 mm. First two whorls diameter 1.5 mm. Embryonic sculpture smooth.

Post-Embryonic Shell Sculpture. Post-embryonic shell with very fine granulations. Sculpture on shell base as on upper parts of shell.

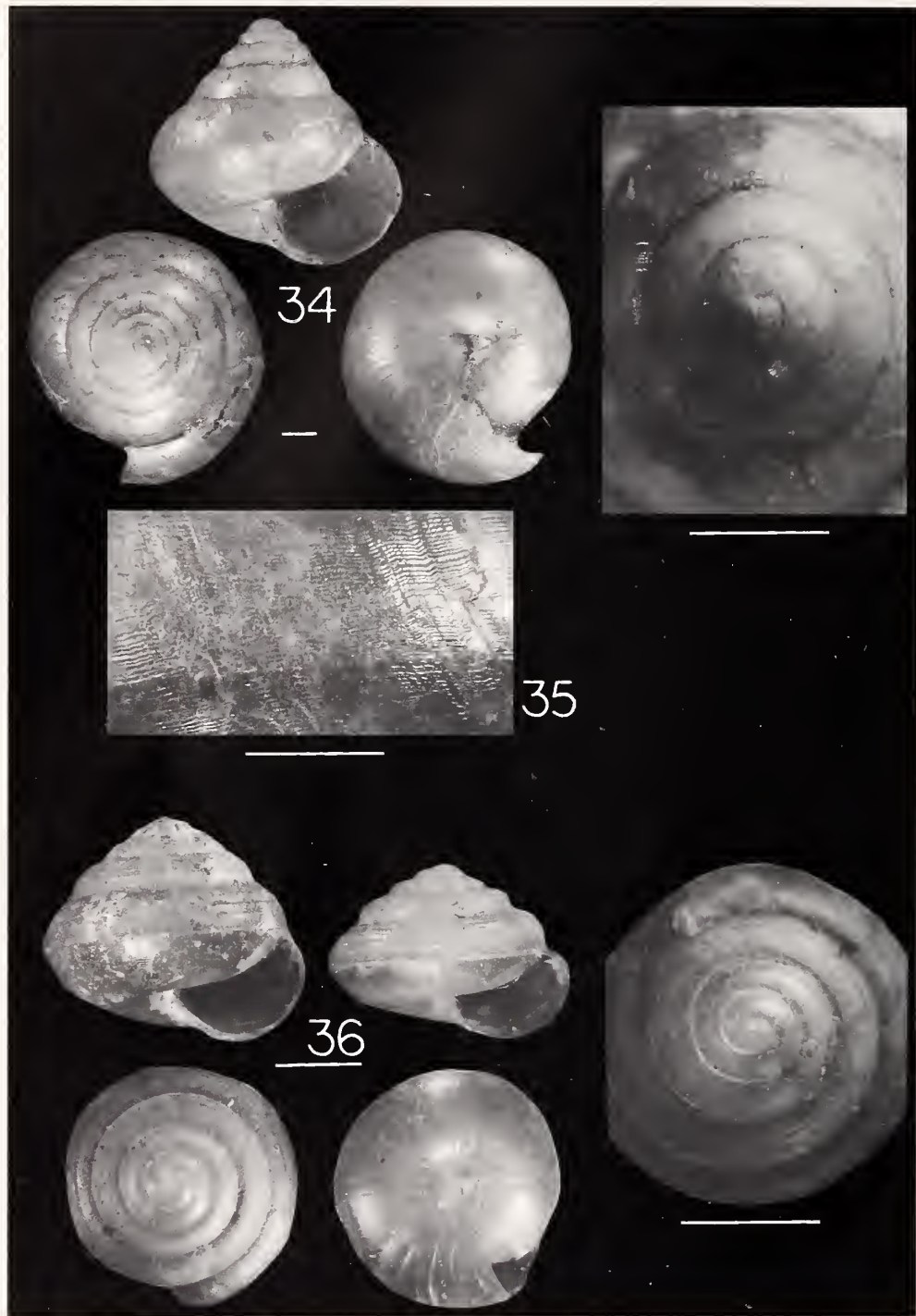
Distribution: Mt. Vasiha, from 100 to 500 m elevation (this paper); Mandraka south to Andringitra (Fischer-Piette et al., 1994).

Comments: This is very likely a new species because of its sculptural differences from described *Sitala amabilis*, but because of its great geographical distance it could be a local variant.

Sitala alicae Emberton & Pearce, sp. nov.

(Figure 36)

Sitala sp. 07, Emberton et al., 1996:209, 210. Emberton, 1997:1146, 1150.**Holotype:** USNM 860839 (ex MBI 384.06DH, Tol-12, ad).**Paratypes:** MBI 377.20DP (7 ad, 3 juv), MBI 377.20AP (2 ad), MBI 378.18DP (7 ad, 1 juv), MBI 378.AP (10 ad, 1 juv), MBI 379.30DP (12 ad, 11 juv), MBI 379.AP (7 ad), MBI 380.22DP (5 ad, 6 juv), MBI 380.22AP (3 ad),



Figures 34–36

Figures 34, 35. *Sitala gaudens* Fischer-Piette & Salvat, 1966, representative from Mt. Ilapiry at 500 m. Figure 36. *Sitala alicae* Emberton & Pearce, sp. nov., paratype MBI 379.30DP (large shell in one standard view) and holotype (smaller, all other views). All scale bars 1 mm.

MBI 381.21DP (5 ad, 4 juv), MBI 382.23DP (11 ad, 17 juv), MBI 382.23AP (2 ad, 2 juv), MBI 383.14DP (5 ad, 3 juv), MBI 384.06DP (9 ad, 8 juv), MBI 384.06AP (2 juv), MBI 385.16DP (3 ad, 32 juv; AMS C.203483 [1 ad]; MNHN [1 ad]; ANSP 400848 [1 ad]), MBI 385.16AP (6 ad, 13 juv), MBI 386.13DP (12 ad, 21 juv), MBI 386.13AP (2 ad, 6 juv), MBI 387.11DP (6 ad, 15 juv), MBI 387.11AP (3 juv), MBI 388.11DP (5 ad, 2 juv), MBI 388.11AP (1 juv).

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: northeast of village of Esetra: east slope of Mt. Vasiha, 500 m, 24°55'19"S, 46°44'45"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 2.8 mm; height 2.0 mm. Height-diameter ratio 0.73. Whorls 4.8. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 4.7. Spire angle 110 degrees. Shell moderately domed. Whorl periphery rounded to slightly angular, presutural ridge present. Suture depth one half whorl from aperture is 2.3% of shell diameter. Umbilicus 7% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 48% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.61. Distance between the columellar and upper peristome insertions 85% of aperture width. Penultimate whorl projects into body whorl, occupying 20% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 90 degrees.

Apex. First whorl diameter 0.6 mm. First two whorls diameter 1.0 mm. Embryonic sculpture smooth then with spiral ridges.

Post-Embryonic Shell Sculpture. Post-embryonic shell with fine spiral ridges and with weak irregular growth wrinkles; six spiral ridges between sutures. Shell base smooth.

Variation: Size and shape vary enormously; the extremes are illustrated in Figure 36. Nearly the full range between these extremes occurs within a single presumed population (station MBI 386).

Comparisons: Unique in its spiral sculpture that is coarse and strong above, fine and weak below.

Distribution: Mts. Ilapiry and Vasiha, 100 to 860 m elevation.

Etymology: For Alice Doolittle, partner of TAP.

Sitala vasihae Emberton & Pearce, sp. nov.

(Figure 37)

Sitala sp. 08, Emberton et al., 1996:210. Emberton, 1997: 1148.

Holotype: USNM 860840 (ex MBI 384.07DH, Tol-12, ad).

Paratypes: None.

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: northeast of village of Esetra: east slope of Mt. Vasiha, 500 m, 24°55'19"S, 46°44'45"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Whorls 4.0. Spire angle 80 degrees. Shell not domed. Whorl periphery rounded to slightly angular, presutural ridge present. Shell color white.

Apex. First whorl diameter 0.5 mm. First two whorls diameter 0.9 mm. Embryonic sculpture of weak spiral ridges then also with weak growth wrinkles.

Post-Embryonic Shell Sculpture. Post-embryonic shell with fine spiral ridges and with weak irregular growth wrinkles; about 10 spiral ridges between sutures, no spiral ridges below shell periphery.

Comparisons: With fine spiral striae and similar spire shape as a juvenile of *Sitala hestia* (Dohrn, 1882), but is smaller.

Distribution: Mt. Vasiha, 500 m elevation.

Etymology: For Mount Vasiha, southern Anosy chain.

Sitala soa Emberton & Pearce, sp. nov.

(Figure 38)

Sitala sp. 09, Emberton et al., 1996:210. Emberton, 1997: 1148.

Holotype: USNM 860841 (ex MBI 383.04DH, Tol-11, ad; body preserved as MBI 383.04AH).

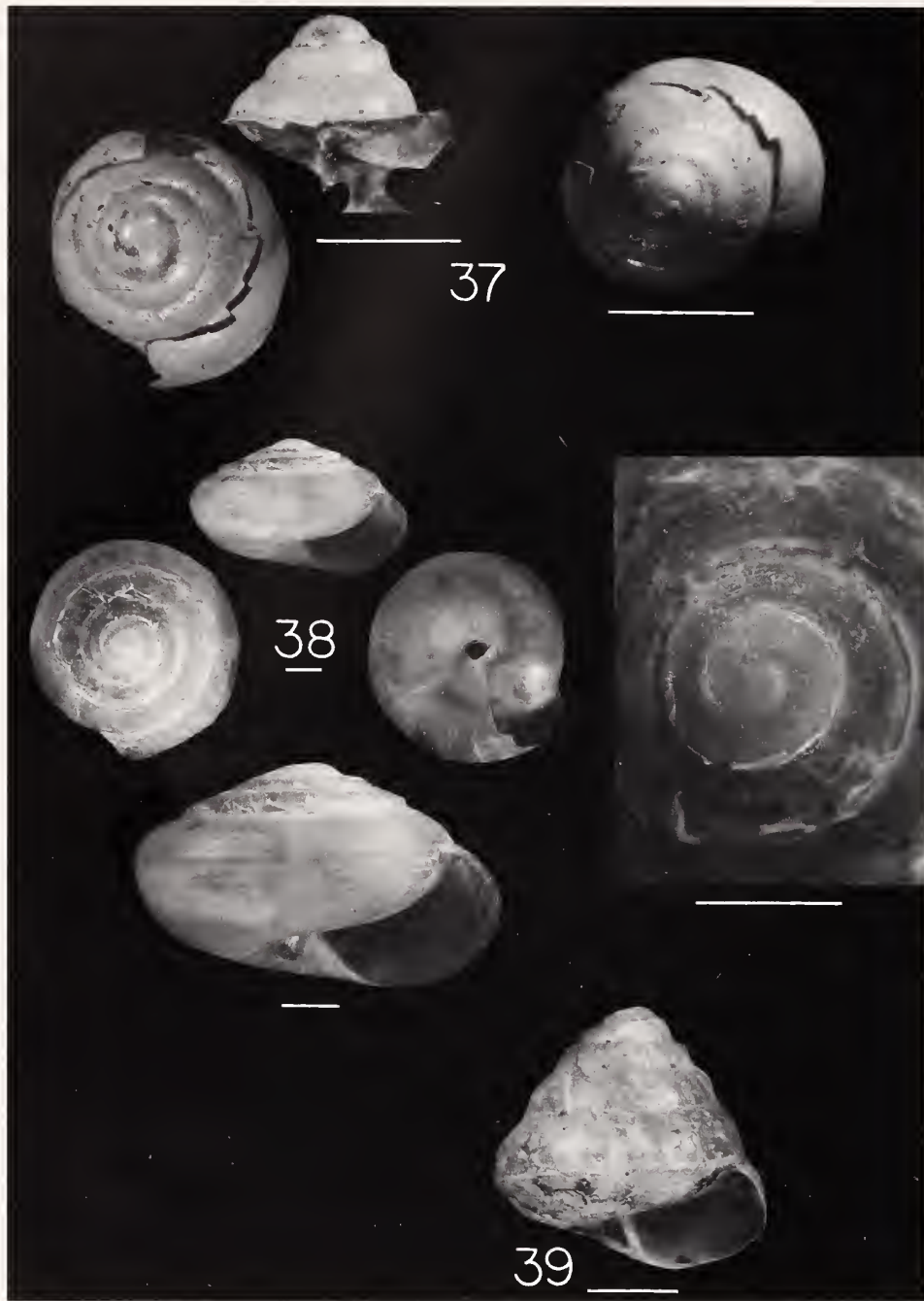
Paratypes: None.

Type locality: Madagascar: Tulear Province: northwest of Fort Dauphin: northeast of village of Esetra: southeast slope of Mt. Vasiha, 700 m, 24°55'23"S, 46°44'27"E: primary rainforest.

Description of holotype:

Shell Size and Shape. Diameter 6.2 mm; height 3.9 mm. Height-diameter ratio 0.63. Whorls 5.3. Coiling tightness (whorl number divided by natural logarithm of shell diameter) 2.9. Spire angle 130 degrees. Shell moderately domed. Whorl periphery rounded to slightly angular, presutural ridge present. Suture depth one half whorl from aperture is 0.7% of shell diameter. Umbilicus 10% of shell diameter. Shell color orange-brown.

Aperture. Aperture width (measured parallel to a line between the columellar and upper peristome insertions) 47% of shell diameter. Aperture height-width ratio (height measured to and perpendicular to a line between the columellar and upper peristome insertions) 0.68. Distance



Figures 37-39

Figure 37. *Sitala vasihae* Emberton & Pearce, sp. nov., holotype. Figure 38. *Sitala soa* Emberton & Pearce, sp. nov., holotype. Figure 39. *Kaliella barrakporensis* (Pfeiffer, 1852), representative from Mt. Mahermana at 300 m. All scale bars 1 mm.

between the columellar and upper peristome insertions 85% of aperture width. Penultimate whorl projects into body whorl, occupying 29% of aperture height measure. Lower peristome angle where it meets parietal wall (apertural view) 65 degrees.

Apex. First whorl diameter 0.9 mm. First two whorls diameter 1.7 mm. Embryonic sculpture smooth then with spiral ridges.

Post-Embryonic Shell Sculpture. Post-embryonic shell with fine spiral ridges and with weak irregular growth wrinkles; about five weak spiral ridges between sutures. Spiral ridges present below shell periphery but shell base smooth.

Comparisons: Unique in its combination of spiral sculpture; low, domed shape; and conspicuous umbilicus.

Distribution: Mt. Vasiha, 700 m elevation.

Etymology: For the beautiful (Malagasy *soa*) shell.

DISCUSSION

These descriptions of 30 helicarionids complete the systematic documentation for our previous distributional and ecological analyses of Mahermana-Ilapiry-Vasiha land snails (Emberton et al., 1996, 1999; Emberton, 1997).

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